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BY MAX LOEWENTHAL.

ARC LAMP PHOTOMETRY.
BY STEPHEN CARLETON ROGERS.

THE STORAGE BATTERY.
BY H. N. SESSIONS.

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1915

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Lamps which give maximum light at minimum cost; which are backed by scientific study, careful selection of materials and the greatest publicity campaign put out by a manufacturer.

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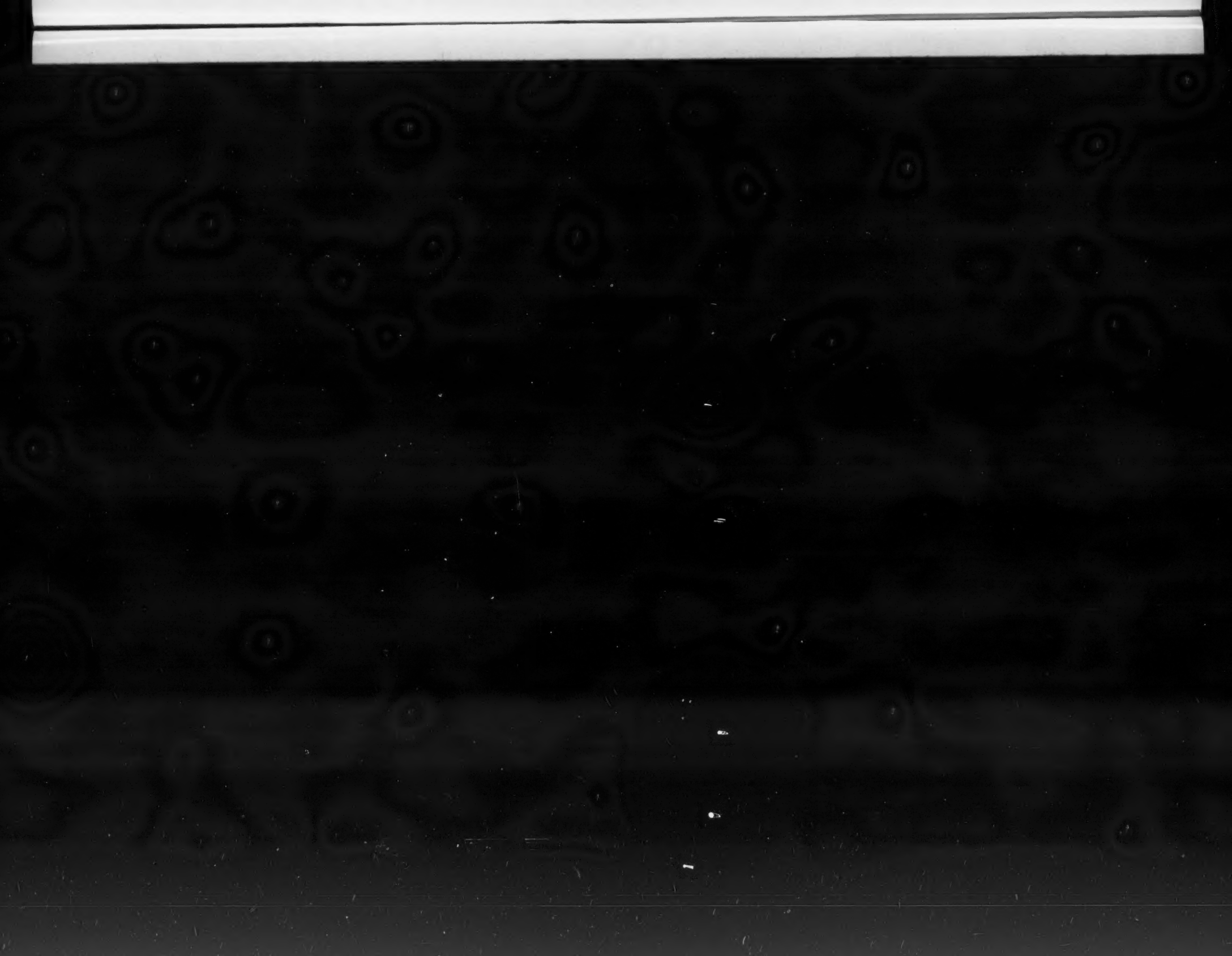

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POWER AND GAS
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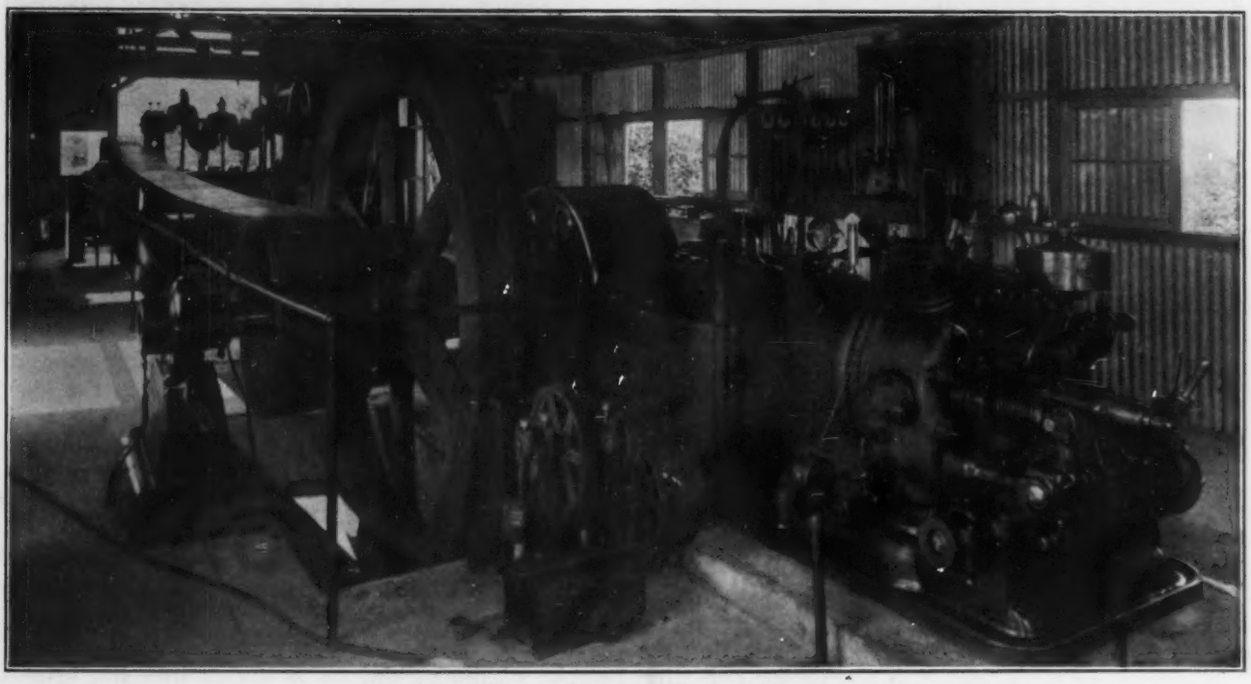
A DIESEL ENGINE IRRIGATION PLANT

BY MAX LOEWENTHAL

The beautiful little town of Corona, situated about fifty miles southeast of Los Angeles, which has only recently, so to speak, been placed on the map of the world through the record breaking speeds attained by the racing autos spinning around the circular track surrounding the town, can lay claim to further distinction in view of its extensive and highly productive orange and lemon groves and because it harbors within its confines one of the most unique and economical deep well irrigation pumping plants in this country.



Diesel Engine Pumping Plant at Corona.

This plant was installed by the Los Angeles branch of Henry R. Worthington about three months ago on the extensive Jameson ranch and has been operated successfully for twenty-four hours each day almost continuously during that time.

This ranch, which is about twenty-two years old, consists of 450 acres of citrus fruit groves of which 250 acres are in bearing trees. There are about 32,000 lemon and orange trees on the ranch, giving a yearly output of about 225 carloads of fruit, which, figuring 400 boxes per car, means an annual yield of over 90,000 boxes of packed fruit. Considerable business capacity and foresight must be exercised in the management of a plant of this size and as its efficiency depends very largely upon the condition of the soil. The solution of the water problem for irrigation purposes, that is, a dependable supply in sufficient quantity and secured at a cost which is not prohibitive, was one which gave the owners much concern and was carefully studied before a final decision was arrived at,

It would seem almost self-evident, when the statement is made that an electrical high tension line runs directly over the roof of the present pump house, that an electric motor would have been installed for the operation of the pump, but as such is not the case, the plant at once becomes of unusual interest to the engineer. In the words of Mr. Joy G. Jameson, who decided in favor of the present equipment, which entailed an expenditure of about $18,000, inclusive of the well work: "Even if we should have been able to obtain current at from ½ to 1 cent per kw.

it would not have paid us to lift the quantity of water required from a depth of over 400 ft. by means of electricity, while the present installation is a profitable and satisfactory investment from every standpoint."

While the conditions here are, no doubt, extraordinary, it must be conceded that most of the 2000 pumping plants which have been installed in Southern California during the past two years, are electrically-driven. But this plant may serve to open up new opportunities for irrigation which have hitherto presented problems considered impossible of solution.

In order to strike pure water, it was necessary to sink a well 630 ft. in depth, while the pump has a lift of 425 ft. and a capacity of 45 in., which is equivalent to a delivery of 405 gallons of water per minute. The installation within the corrugated iron

Jameson Ranch Pump House.

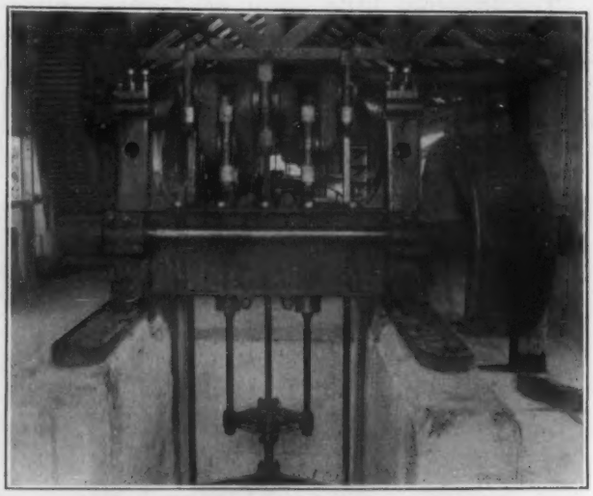
pump house, 20 ft. x 50 ft. in size, standing at the edge of one of the extensive lemon groves, consists of the following machinery: A 65 h.p. 4-cycle Snow crude oil engine, of the Diesel type, together with a 3 x 4 triplex water jacket pump, a 1¾ x 2½ triplex fuel oil pump, a 3½ x 3½ air compressor for starting the main engine, an 8 h.p. distillate engine for operating the compressor and operating a heavy pattern, double gear hoist, used in connection with the deep well pump to enable quick handling of rods in case of emergency.

The crude oil engine, which operates at a speed of 225 r.p.m., is connected by means of a 16 in. belt with 34 ft. centers to a Glendora triple plunger pump with 9½ in. triple buckets operated by rods weighing 13 tons. This pump, which is thrown into action by means of a clutch, as shown in the illustration, is surmounted by a 65 ft. derrick extending far above the roof of the house, by means of which two lengths of column pipe or two lengths of triple rods can be handled at one time, thus saving one-half the time in case of emergency.

For furnishing current for the 24 incandescent lamps in the house, a small 2 h.p. General Electric generator was installed, which is operated by means of a friction pulley from the main flywheel of the Snow engine, thus making the plant entirely independent of outside current supply.

The engine uses 18 gravity California crude oil, kept in a 50 gallon service tank, some distance from the plant. The oil consumption for the operation of this pump is less than two barrels per 24 hours, at a cost of about $1.00 per barrel.

The crude oil engine is distinguished from the explosive engine, such as gas, kerosene, or gasoline engines, in that the impelling force applied to the piston is not an explosion of a fuel and air mixture, but a complete combustion of the fuel in highly compressed air. This form of combustion permits the engine to run evenly and quietly, increases the durability of all moving parts and is particularly well



Power Head of Glendora Deep Well Pump.

adapted to close regulation. No ignition apparatus is necessary, as the fuel is self igniting in the highly compressed air in the combustion space. The engine is at all times ready for operation, as no heating up of any vaporizing chambers or other parts is necessary. The engine can be started, brought up to speed and ready to take full load in less than a minute. The movement of a single lever puts the engine in service, and when not in service, there are no stand-by losses.

On this four cycle engine at the first forward stroke of the piston, air is drawn into the cylinder, completely filling it. On the return stroke this air is compressed into the clearance space to about 500 lb. pressure, and as the piston approaches the end of the stroke, the spray valve is suddenly opened, and the fuel which was deposited in the spray nozzle on the suction stroke is at once thoroughly atomized and injected into the clearance space, causing complete combustion in the highly compressed air, the combustion thus imparting its energy to the piston on the outward stroke without subjecting its parts to any shock. The fourth or exhaust stroke then takes place, completing the cycle.

The pump gives approximately three times the volume of water that can be obtained with a single-acting pump of the same size and approximately fifty per cent more than either the double-acting or the two-plunger pumps.

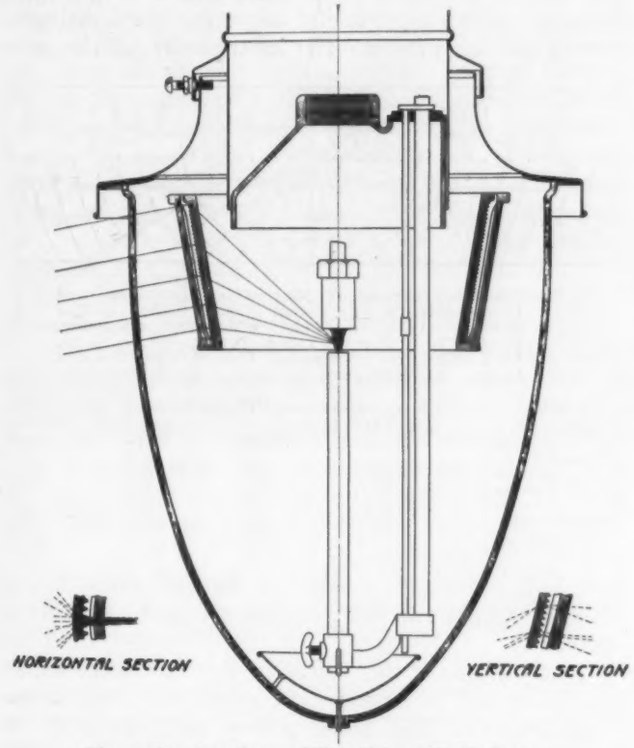
LIGHTING METHODS

LETTER TO THE EDITOR.

Arc Lamp Photometry.

Sir:—I have just read an article in the October 10th issue of the Journal of Electricity, Power and Gas, entitled "Arc Lamp Photometry," by Ford W. Harris. This article as a whole is very good, but there are several statements and impressions I would like to have corrected.

In the third paragraph of this paper, Mr. Harris comments upon the variation in candle power or the average light given by electrodes, particularly those used in the magnetite arc lamps. He states that this variation in electrodes can be easily exaggerated if desired in mixing samples.



Magnetite Arc Lamp With Prismatic Reflector.

In the first place, these magnetite electrodes are made by only two companies which are the largest and most reliable manufacturers of electrical apparatus in the United States, and I know that one of these two manufacturers does not and the other would not stoop to such a practice. At the present time there are two distinct types of electrodes, one commonly known as the "long life" electrode and the other as the "high efficiency" electrode. Secondly, neither of these manufacturers would be apt to place on the market an electrode which would give trouble from slagging and unsteadiness.

Mr. Harris' method of testing arc lamps is open to serious error. His method is to determine the shape of the distribution curve quite apart from the luminous intensity, then to determine the "intensity at a certain angle" and finally to find the average total life over a long period. The shape of a distribution curve, particularly with a magnetite arc lamp, differs extremely with the length of arc, and since this length of arc is different at various currents, it will be seen that the shape of the curve for 4 amperes will be different from that at 6.6 amperes or other current, and, if this shape has been determined at some unknown current and some unknown intensity, no matter what the "intensity at a certain angle" may be, it would be impossible for him to plot this "intensity" and obtain an accurate distribution curve of the arc lamp.

When complete distribution curves of arc lamps are made in the arc lamp photometric testing laboratory, two or three observers each take at least ten readings at every 10 degree angle (and some of the 5 degree angles when necessary) and several complete sets of readings are made, using different electrodes taken at random from stock. The readings are taken at designated automatic time intervals, thereby eliminating an error which Mr. Harris did not mention, since the observer will read not only the high values but the low ones due to the instantaneous position of the arc, such as directly after feeding, etc. These sets of readings, taken by different observers and with different electrodes are all averaged together and the curve is plotted from these averaged values. In addition to this test, electrodes are also sent to the illuminating engineering laboratory where check tests are made by different observers and with other electrodes. This laboratory is wholly independent from the arc lamp testing laboratory and moreover is even in a different state.

Sometimes a curve is made, from only one or two electrodes and possibly only one or two complete sets of readings. Therefore in such cases, the curves thus made are marked "preliminary" to distinguish them from the other standard curves.

Whenever the material for a new lot of electrodes is prepared, a number of electrodes are made up from this mixture, put on life test and photometric readings made at different times during their life.

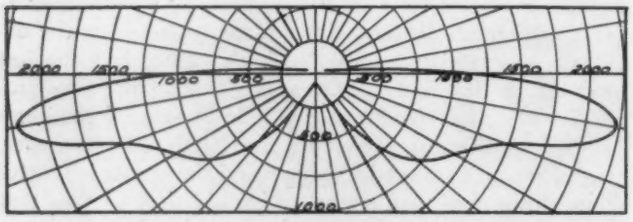
The candle power and life must come within predetermined limits before approval can be granted to release this mixture for the making up of electrodes. All of the raw material is analyzed very carefully by several expert chemists and handled in a scientific manner, the raw materials being both magnetic and water separated.

In the latter part of the paper the author states "The two points most interesting to a user is the light emitted at an angle of 15 degrees below the horizontal and the shadows cast. . . . That lamp is the best which throws no shadows, and no amount of distribution curves can effect a practical demonstration of this kind." If the shadow is directly underneath the lamp, this objection disappears, since at the present time practically all lamps, arc or incandescent, are giving too much light, if anything, directly underneath and not enough in the spaces half way between the lamps, so a shadow here is unobjectionable from an illumination standpoint. Shadows have practically no effect on the illumination but look bad if too pro-

nounced. Any other shadow from an arc lamp that is objectionable may be eliminated if desired by the use of a diffusing globe instead of a clear globe, and, in some cases by merely sand-blasting the bottom of a clear globe, and this is particularly recommended whenever lamps are hung low, that is 20 ft. or less.

In the last paragraph, the statement is made that "The candle power of arc lamps is regularly over-estimated by the manufacturers." This is not the case, in fact, the values as given out are under rather than over-estimated. A statement is made that the 4 ampere magnetite gives a maximum between 450 and 600 candle power and the 6.6 ampere magnetite from 800 to 1200 candle power, depending on the electrodes. The 4 ampere magnatic lamp, thousands of which are in operation throughout the United States at the present time, gives a maximum of 630 candle power at 10 degrees below the horizontal with the long life electrode.

The 6.6 ampere lamp equipped with the long life electrode gives over 1500 maximum ray candle power



Photometric Curve of Magnetite Luminous Arc Lamp.—75-80 volts, d.c. series circuit, 5 amperes, 206 lumens per watt. Upper electrode 1 in. dia. copper; lower 11/16 in. high efficiency mix.

and electrodes giving any such discrepancies as stated by Mr. Harris could not leave the factory. These lamps of course are equipped with clear globes.

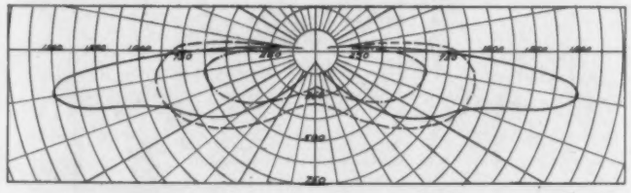
Since receiving this Journal of October 10th, a dozen of these long life electrodes were selected at random and tested out in the two distinctly separate laboratories above mentioned and all showed values well above those shown on standard curves.

Perhaps Mr. Harris in this article referred to these lamps when equipped with diffusing globes and if so his values would be approximately correct, depending of course on the density of the globe used, but it has not been customary to give values when equipped with diffusing globes unless that fact has been so stated since this is due to the very wide variation in globe densities and globe absorptions.

He also states that "The 4 ampere magnetite is at present the most practical arc lamp for residence street lighting and the luminous flame or impregnated carbon arc the most practical for display or business street lighting. It is probable, however, that unless rapid improvements are made in arc lamps that the new nitrogen filled tungstens will largely supersede them."

I will consider the last sentence first. It is evident that Mr. Harris has not kept in very close touch with the recent improvements made in arc lamps. In the March, 1914, "Lighting" issue of the General Electric Review there appeared an article of considerable length by Mr. C. A. B. Halvorson Jr. on "Improvements in the Magnetite Arc." In this article Mr. Halvorson wrote about the new high efficiency magnetite electrode. The lamps referred to above when equipped with the high efficiency electrodes will give 925 candle power maximum at 4 amperes and 2100 candle power at 6.6 amperes with clear globes, thereby reducing the specific consumption of these lamps from .63 to .42 watts per mhscp for the 4 amperes and from .403 to .31 watts per mhscp for the 6.6 ampere lamp. More recent than this, however, a new design of magnetite lamp has been brought out to which has been adapted a specially designed prismatic refractor.

This prismatic refractor consists of two truncated conical glass globes, open at the top and bottom, fitting inside one another and forming a single unit which is smooth on both inside and outside surfaces. The inner section is girdled by a succession of horizontal prisms which intercept all the available light rays given off from the arc above the horizontal and deflect them downward at an angle of 10 degrees below the horizontal, (as shown in the vertical section in the accompanying illustration), which is generally accepted as the most useful angle for the lighting of streets and large areas. The inner surface of the outer



Photometric Curves of Magnetite Luminous Arc Lamp.—Heavy line, Form 17 Lamp, No. 449 Reflector, 11/16 in. high efficiency electrode. Broken line, Form 3 Lamp, Int. Reflector, ⅝ in. high efficiency electrode. Dotted line, Form 3 Lamp, Int. Reflector, ⅝ in. Standard electrode.

Electrode	High Efficiency.		Std.
Equipment.....No. 4449 Refractor		Internal Reflector	
Volts at terminals	75-80	75-80	75-80
Amperes	4.	4.	4.
Watts at terminals	310.	310.	310.
Mean hemispherical C.P.	741.	736.	488.
Watts per M.H.S., C.P.	.42	.42	.63
Mean spherical C.P.	425.	385.	256.
Watts per M.S., C. P.	.73	.81	1.21
Lumens per watt	17.2	15.6	10.4

section is lined with a series of vertical prisms which serve to diffuse the light (as shown in the horizontal section).

By the use of this refractor the maximum values are materially increased at 4 amperes. This means a maximum of 900 candle power with the long life electrode and 1500 candle power with the high efficiency electrode and 3250 candle power at 6.6 amperes. At the same time there has been standardized a magnetite arc lamp which operates at 5 amperes and has a very low specific consumption. When equipped with this prismatic refractor this gives a maximum of 2200 candle power at 5 amperes.

This new lamp at 4, 5 or 6.6 amperes may be used with or without the prismatic refractor. When used without prismatic refractor it should always be equipped with a proper diffusing globe. The maximum values in this case are very much reduced.

In regard to the 4 ampere lamp—I agree that the most practical arc lamp for residence street lighting is the 4 or 5 ampere magnetite arc lamp, but the ornamental luminous arc lamp, at 4, 5 or 6.6 amperes, of which there are over 10,000 in the business districts of 80 odd cities, is the best for display or business street lighting.

STEPHEN CARLETON ROGERS.

West Lynn, Mass.

STORAGE BATTERIES

(The three papers on storage batteries which were presented at the Dec. 8, 1914, meeting of the Los Angeles Section of the American Institute of Electrical Engineers are here printed in full. Mr. Sessions, who is commercial engineer with the Southern California Edison Company, gives a rapid fire resume of the subject, Mr. Solomon, as the representative of the Gould Storage Battery Company, upholds the lead type, while Mr. Rogan, as the agent for the Edison battery, describes the alkaline battery. Taken together they form a practical symposium on the subject.—The Editor.)

THE STORAGE BATTERY.

BY H. N. SESSIONS.

I plead guilty before this meeting to the charge of battery. Knowing the seriousness or specific gravity of such a charge, I expect that you will sentence and confine me to a storage cell for one ampere hour; hence reading this paper at 10 ampere rate will give you six minutes of plain talk on storage batteries.

Since Plante, the famous French electrician, gave us the first practical storage battery fifty-four years ago, its career, till now, has been unsettled. Its uses were special and limited. At last we have found a need for it so general and extensive that we shall soon debate in our minds which was responsible for the other, the electric vehicle or the storage battery. Our modern gas car depends on the storage battery for ignition, lights, horn, self-starter and the electrical shifting of gears. The next stride of evolution gives us the all-electric vehicle, the very heart of which is the storage battery. This has put the storage battery to such universal use that, like the camera for example, it is being operated by the amateur and the professional with good results to both when it is understood and cared for.

We, in the electrical business, engineers, salesmen, etc., are looked upon alike by the public as electrical men posted on electrical affairs. We have the name and are credited with the game, so let us play it today with storage batteries as trumps. The practice will fit us to deserve the reputation we enjoy and enable us to give wholesome advice to the layman.

We are familiar with the many species of voltaic or primary battery which develops electrical energy by the direct chemical decomposition of the solution or electrolyte and of one or both its elements. The storage or secondary battery, sometimes termed the accumulator cell, differs from the voltaic or primary battery in that, although quite inactive or inert in itself, yet, on passing an electric current through it, certain chemical changes are induced rendering it capable to receive, hold and redevelop electrical energy. Chemistry is picking for us a combination for the storage battery composed of the proper constituents for the ideal with higher capacity, less weight and longer life or endurance. The high development of these three qualities is marked today in the lead-acid and the nickel-iron-alkaline or Edison battery, the lead battery standing for high electrical efficiency and short life as against the Edison battery of lower electrical efficiency compensated for by longer life. While their chemical constituents differ, these two classes of battery are practically the same in principle of construction and operation. Each consists of a postive and negative element immersed in a solution or electrolyte. The difference of potential between the positive and negative plates or elements is acted upon by the electrolyte, causing a current to be chemically produced. The rate of a battery's delivery in amperes per hour is governed chiefly by the area of its plates and the electrical resistance of the intervening electrolyte. Strange to say, the electrolyte which is a good conductor at the proper specific gravity, is composed of two very poor conductors. For example, pure water and sulphuric acid separately have a high electrical resistance, but in combination by weight one-third acid to two-thirds water, approximately 1.250 specific gravity, we have a conducting medium of low resistance. This same feature exists with the caustic potash or alkaline electrolyte. It is peculiar to note that sulphuric acid and water occupy less cubic volume in combination than when separated. This fact, together with the heat evolved when they are mixed, seems to prove that the acid electrolyte is a chemical rather than a physical combination, thus explaining why an acid solution does not stratify as the alkaline electrolyte does when standing idle at low temperature. Such strata necessarily are of various specific gravities either above or below the average gravity of least resistance. This is my only explanation as to why the Edison cell does not accumulate its charge as readily as the lead-acid cell on extremely low charging currents. A good wrinkle for making acid electrolyte quickly in an emergency is to mix sulphuric acid with clear ice, thus insuring a cheap, cold distilled water electrolyte ready for use. Sulphuric acid attacks steel. Potash preserves it, hence the Edison battery is contained in steel, and the lead-acid battery in rubber. This is an enormous advantage in favor of the alkaline battery as the steel jars are not only stronger than rubber, but radiate their heat better. I hope we may yet see the lead cell encased in a steel jar protected inside and out with a lead coating which will not be attacked by sulphuric acid.

Referring to the preserving effect of an alkali on steel, please do not believe James F. Rogan, agent for the Edison storage battery if he tells you that an alkali solution is good to drink. James knows the difference between alkali and alcohol. Oh! You Rogue-an alka-liar. The watt-hour efficiencies of the nickel-iron-alkaline and the lead-acid batteries are approximately 60 per cent and 80 per cent respectively; hence each of these classes of battery must receive the necessary excess charge to compensate for their deficiency.

The voltage of a storage cell signifies little unless taken while current is passing through it either in charge or discharge. It then becomes a truthful indicator of the cell's condition. The voltage of a cell is simply the difference of potential between its plates or elements and is the same regardless of the size or weight of the battery. The size and weight of the plates however, determine the output or capacity of a cell ordinarily measured and expressed in ampere hours. A complete account of the chemical reactions in the storage battery is too extensive to be given here,

but the eventual result of charging any storage battery is, that water is decomposed into its constituents, hydrogen and oxygen gases. The oxygen is liberated at the positive plate, which becomes highly oxidized, while hydrogen is accumulated at the negative plate. In discharging, the oxygen of the positive plate decomposes the electrolyte, combining with its hydrogen, and so travels through to the negative plate, combining with it. The plates of any storage battery consist of a suitable metallic frame or grid which holds what we term active-material. In the lead battery this active material is peroxide of lead at the positive plate and pure porous lead at the negative. In the Edison battery the active material of the positive plate is nickel-oxide and of the negative plate metallic iron. Ampere hour capacity is largely proportional to the volume of oxidizing or active material held by the plates, consequently the cubic size and weight of a cell is in fair proportion to its ampere hour output or capacity. The active material of a storage battery must at intervals be expanded by charging to its fullest extent, otherwise it will shrink and cease to be porous and wholly active just as our lungs would become without an occasional full breath. Starving a storage battery by undercharging it is poor economy, particularly with a lead battery, because such practice will entail long overcharging at a low rate followed by many cycles of charge and discharge to eradicate lead sulphate in the active material and bring the specific gravity back to normal. More injury is done a storage battery by allowing it to heat in charging than in any other way. The best results are obtained when the temperature is kept below 90 degrees Fahrenheit. It should never be allowed to rise above 100 degrees Fahrenheit. The lower the temperature is kept during charging, the longer will be the life of the battery, and the shorter can be the time of charge, if necessary. It is astonishing how rapidly a battery can be charged when the temperature is kept down. After all is said and done, if these three features, namely, specific gravity, voltage and temperature, are watched and kept within normal bounds while charging and discharging, any standard type of storage cell today will give satisfaction.

The public conception of the vehicle storage battery is a set of clammy, uncanny, black coffin-like trays containing very heavy sloppy boxes or cans full of a mysterious electrified fluid that spits, sparks, smokes and smells, commonly called "juice."

THE EDISON ALKALINE STORAGE BATTERY.

BY JAMES F. ROGAN.

A storage battery is commonly looked upon as a receptacle in which to store electricity. Electricity is not concrete matter. (In fact nobody knows just what it is.) Therefore, in the general comprehension of the term, it is not stored. Electricity simply causes a chemical change to be effected in certain substances, when it is caused to flow through them. These substances, in endeavoring to return to their original state, produce electricity.

Suppose we place two pieces of very thin bright steel out of doors for a few weeks. They become "rusted." The action of the oxygen on the outer layer of the metal has formed it into an oxide commonly known as "rust."

Now, let us place these two pieces of steel into a solution composed of potash and water, and connect them by wires to a small dynamo. The electricity, in flowing from the dynamo through the solution, from one of the plates to the other, and back to the dynamo, changes the rust to metallic iron on one of the plates, but causes the other plate to become "rusted" twice as much as before.

Now, let us disconnect the plates from the dynamo and connect them, by means of pieces of wire, to an ammeter. Instantly, the excess oxygen in the rust on the one plate commences to pass back to the bright plate and, by so doing, causes electricity to be generated. Why? Nobody really knows.

We have now charged and discharged a primitive storage battery.

Instead of two thin rusted steel plates, let us mount, say, one hundred such plates, equidistantly spaced, on one rod, and one hundred more on another rod. Now suppose we interpose the two groups so the plates of the two groups will not touch each other, and then connect them to our dynamo. The electricity will flow from one group, through the solution, to the other group, converting the oxide of one group to metallic iron, and increasing the amount of oxide on the other group. We will be able to get much more electricity from the battery thus formed, because of the greater plate surface exposed.

We have thus determined that large surface is necessary.

Let us next place a lot of fine particles of iron rust into two perforated flat steel pockets and, after putting these pockets into potash solution, pass electricity from one to the other, through the solution, as before. All the iron rust in one pocket will be changed to metallic iron, because the oxygen will have passed over to the iron rust in the other pocket, causing this material to possess twice as much oxygen as before. The super-oxidized pocket tends to swell to a cylindrical shape.

Now, when you connect the two pockets to your ammeter, you will find that much more electricity is flowing than before, although the two pockets take up much less space than the two hundred steel plates. The reason of this is, the small particles present a very great combined surface to the solution.

Suppose, after having a great number of experiments, you find if you put some iron rust—iron oxide—into perforated steel pockets, and mount a lot of these pockets on a steel grid or support to form one plate, and place nickel hydrate (a green powder) into perforated steel tubes, and mount these tubes on another steel grid to form the other plate, you will have arrived at the point Mr. Edison reached when he discovered the Edison storage battery.

The electricity, in flowing through the solution from the "tube" or positive plate to the "pocket" or negative plate, causes the oxygen in the iron oxide of the pockets to come over to the green nickel hydrate. This oxidizes the hydrate and forms a new kind of nickel oxide, heretofore unknown chemically. This oxidizing of the hydrate tends to cause the tubes to swell. But they are already round—cylindrical—

and are furthermore reinforced by a number of seamless steel rings placed around them. It is therefore apparent that they cannot swell.

We continue to pass the current through until the iron oxide in the pockets has been converted into metallic iron, and the green nickel hydrate, in the tubes, becomes black nickel oxide. Then when we connect these two plates to our ammeter, the increased capacity will be apparent.

At this point we still find, however, there is room for improvement, just as Mr. Edison found.

Some substances permit more light to pass through them than do other substances. Likewise, some substances present greater resistance to the passage of electricity through them than do other substances. This nickel oxide in the positive plates has high electrical resistance. So it becomes necessary to divide it up into very thin layers, and to conduct the electricity to these layers by intervening layers of metal.

I will explain to you later how this was accomplished. It was exceedingly difficult to achieve, and cost Mr. Edison much money and effort.

The loading of the tubes is accomplished by an automatic machine operating as follows:

After the perforated steel tubes have been made, they are placed vertically into iron clamps directly under a row of fixed tubes, through which metal rods pass. After a little metal cap has been inserted into each of the tubes, the machine is put into operation, and a very small quantity of green nickel hydrate—the green powder—is allowed to fall into the tubes. On top of this falls, in an evenly distributed layer, some very finely divided metallic nickel scales. The metal rods descend, and under a pressure of about two thousand pounds to the square inch, forces this thin layer of nickel scales into very intimate contact with the thin layer of nickel hydrate. The rods are raised and the performance repeated, until a total of seven hundred alternate layers of nickel hydrate and flake nickel have been tamped together. Besides making intimate contact with the successive layers of nickel oxide, the layers of nickel flake make like contact with the sides of the tubes, so that when the tube is placed into a solution of potash and water, the charging current passes to these layers of flake nickel, and through the thin layers of nickel hydrate for the purpose explained.

After the tubes have been filled, they are removed from the iron clamps, another metal cap is inserted in the top of each, and the two ends are mashed flat. The tube is then placed into a machine which forces the seamless steel rings over it, equidistantly spacing them. Thirty of the tubes are then mounted on grids and firmly clamped thereto by means of retaining ears forming part of the grid.

The negative pockets are formed into two halves, open at the top. These pockets are clamped in a device, and loaded with iron oxide by machines similar to the tube-loading machines, although it is not necessary to interpose layers of metallic nickel flake, because iron oxide has lower resistance than the nickel oxide in the positive tube. The conductivity of the iron oxide is increased by mixing with it a little mercury, which is all sufficient.

Twenty-four of these pockets are placed into interstices of a steel grid and subjected to hydraulic pressure, which firmly clamps them to the grid. It also corrugates the sides of the pockets, imparting to the said sides sufficient elasticity to cause them to always adhere tightly to the iron oxide mass within.

We now come to the assembly of these positive plates and negative plates, to form a battery.

For convenience, we will mount four of our positive plates on a steel rod, the plates being equidistantly spaced by means of steel washers fitting over the rods and between the plates.

We similarly mount five negative plates on such a rod. Two nuts at the ends of each of these rods, when tightened, firmly clamp the plates.

We now sandwich the four positives and five negatives together, so that, between the negative plates, positive plates are interposed.

It becomes necessary to keep these plates from touching. We therefore place a number of hard rubber rods between them, the crevice formed between adjoining tubes of the positive plates providing a channel to hold the little rods in position.

We then fit the hard rubber ladder pieces to the edges of the plates. The cross members of these ladders have little grooves, so that the edges of the positive and negative plates fit into them, as a drawer fits into a table. This keeps the edges apart.

There must be a receptacle into which to place this combination of plates so nested together. The can, as this container is called, is made up of sheet steel, all seams of which are welded by means of the oxygen-acetylene blow pipe. The sides of the can are corrugated, to provide mechanical strength and radiating surface.

The hard rubber bottom support is placed into this steel can; the nested plates are slipped in with their hard rubber ladders in place; two thin sheets of hard rubber are slipped in between the sides of the can and the outside negative plates, and the entire unit is ready for the top.

After two hard rubber washers have been placed over the vertical pole pieces the top is put in position and likewise welded to the can. Please note that the top is welded on. Pretty good indication that we do not expect to have to get into the Edison cell again.

The fittings through which the vertical poles or terminals pass, are provided with soft rubber washers and means for expanding these soft rubber washers to form a gas-tight and liquid-tight joint between the top of the can and the poles.

Mounted on the top of the cell is an aperture through which the solution is put into the cell originally, and also through which the solution is replenished with distilled water, from time to time, as will be explained later. In the top of this aperture is a little valve, which allows the gas generated within the cell, when it is being charged, to get out of the cell, but which prevents any exterior impurities, air, etc., from getting into the cell.

After the solution, consisting of potash, distilled water and a small amount of lithium, is put into the cell, it is placed on charge and discharge, successively, for three complete cycles, after which it is ready for shipment.

The mechanical parts of the Edison battery are composed of the highest grade of steel throughout. These steel parts are heavily nickel plated, after which they are placed in retorts, hermetically sealed, and hydrogen gas fed thereto. The retorts are placed in a furnace and brought up to the proper heat, at which the nickel becomes firmly welded to the surface of the steel. This forms an impervious preserving coating of nickel for the exterior of the cell, and provides excellent electrical contact of all the parts. This process is one of the many that had to be invented and perfected for the manufacture of the Edison battery.

The cells are mounted in wooden trays with hard rubber pockets in the side slats which receive buttons on the sides of the cells and secure the cells firmly in place.

The electrical connections between cells are then completed, the positive pole of one being connected to the negative pole of the next, and so on. These connections fit over the tapered poles or terminals of the cells, and are brought into intimate contact therewith by the nuts on the ends of the poles. Therefore, to remove a cell from a tray, or to disconnect one cell from the other, it is only necessary to remove the nuts and, by means of a little jack, pull the connection off the pole. There is no sawing through connectors when disconnecting, nor lead burning necessary when setting up a battery.

Although previously mentioned in this paper, it will probably be of interest to look further into the electro-chemical action, as follows:

Starting with oxide of iron in the negative, green nickel hydrate in the positive and potassium hydrate in the solution the first charging of a cell reduces the iron oxide, to metallic iron while converting the nickel hydrate to a very high oxide of nickel, black in color. On discharge, the metallic iron goes back to iron oxide and the high nickel oxide goes to a lower oxide, but not to its original form of green nickel hydrate, and every cycle thereafter the positive charges to a high nickel oxide. Current passing in either direction (charge or discharge) decomposes the potassium hydrate of the electrolyte and the oxidation and the reduction at the electrodes are brought about by the action of its elements. An amount of potassium hydrate equal to that decomposed is always reformed at one of the electrodes by a secondary chemical reaction and consequently there is none of it lost and its density remains constant.

The eventual results of charging therefore is a transference of oxygen from the iron to the nickel electrode and that of discharging is a transference back again. This is why the Edison battery is simetimes called an "oxygen-lift" cell.

When both electrodes become fully charged the elements of the decomposed potassium hydrate can no longer act on them, and instead they re-act to produce hydrogen and oxygen, the elements of water which are given off as gas.

Nickel flakes in the positive and mercury in the negative do not take part in the chemical reaction, but are used solely to bring the particles of active material into good electrical contact with the conducting support.

The electrical efficiency of an Edison battery will all run about the same per cent and we will use the A-Four Type 150 ampere hour battery for illustration, and I will give you the complete data on this cell.

The weight of the cell is 13.5 lb. The ampere hour capacity is, as I have stated, 150 ampere hours when the cell is first put into use, and the normal actual output from a seven-hour charge is 168 ampere hours. The maximum output on overcharge from this cell is 190 amps. This cell is charged under normal charging conditions 7 hours at 30 ampere hours, and the normal discharge rate is figured five hours.

The watt hour capacity of this cell is 180. The normal actual output from a seven hour charge is 202 watts, and the maximum output from overcharge is 228 watts.

The rated capacity per pound in watt hours is 13.3; the normal output per pound from the 7 hour charge is 15.0. The maximum output per pound is 16.9.

The discharge rates of this type cell is 30 amperes. The maximum rate for intermittent discharge is 180 amperes. The watt equivalent of normal rate is 36. The watt equivalent of maximum ampere rate is 133.

The average voltage, discharging at the 5 hour rate, is 1.20. Discharging at 1/5 normal rate, the voltage rises to 1.28. While discharging at five times the normal rate, which is one hour, the voltage is lowered to .84.

The internal resistance of the Edison battery has long been the bone of contention among electrical engineers. The mean effective internal resistance of the A-Four Type is .003.

The normal ampere hour efficiency of all of the A-Type cells is 80 per cent. The normal watt hour efficiency is 60 per cent.

In reference to installation of Edison batteries in Southern California, I wish to cite one instance in particular of a set of 96 cells A-8 300 ampere hours, which are used by the Southern California Edison Company at their Long Beach steam plant for the operation of remote control oil switches. These were put in service August 11, 1911, and have been floated continuously on the line since that date, with the exception of eighteen hours when batteries were discharged and the solution renewed in them. When the batteries were discharged after being on the line two years and nine months, they showed an actual ampere hour discharge of 330 amperes.

I also may state that this company has 21 electric vehicles, all equipped with Edison batteries, some of them having been in use nearly four years, and all of them giving the best of continuous service.

Another installation is a set of 60 cells of A-6 225 amperes, which were shipped to Los Angeles, about six years ago, and were used in a one ton Lansden hotel bus owned by the King Edward Hotel. This bus was run continuously for over five years, and was in service approximately 18 hours per day. The batteries recently were removed and put in another chassis owned by Walter E. Smith Company and are now used in grocery deliveries. As this is the oldest set that we have any record of here in

California, it only goes to show the long life the batteries will stand up to with any reasonable care and attention.

The Edison Storage battery for train lighting consists of 25 cells of the A-8-H Type for 30 volt axle generator system, which system is the most generally used in the United States. This standard train-lighting set only weighs 890 pounds, as compared with about 3000 lb. for the same capacity of lead batteries, and requires only about two-thirds of the space.

The Pennsylvania railroad has in actual use about 17,000 of the A-18-H Type batteries and 500 more on order.

The Edison Storage Battery can be put on charge for five times its normal rate for a period of five minutes; four times its normal rate for fifteen minutes, three times its normal rate for thirty minutes and twice its normal rate for one hour. It can also be discharged at five times its normal rate or the cell or series of cells can be short-circuited without any injury to the battery.

LEAD STORAGE BATTERY.

BY I. R. SOLOMON.

History: The electrical industries today are enabled to practically employ the lead storage battery as a direct result of the experiments of two scientists, one by surname of Plante and the other by surname of Faure. Over forty years ago Plante discovered that solid lead plates immersed in an electrolyte of diluted sulphuric acid would undergo a chemical change when a direct current of electricity was allowed to pass for a given time. The plate connected to the positive pole would become a dark chocolate color, and the plate connected to the negative pole would become distinctly grey and spongy in appearance. After disconnecting the outside sources of electricity Plante found that an electrical current could be obtained in an opposite direction from the lead couple immersed in the diluted sulphuric acid.

Faure later on discovered that the same results as obtained by Plante could be obtained if lead grids were filled with lead oxide.

Theory: The lead storage battery is composed of a number of lead storage cells, connected in series or multiple. The individual cell is practically a primary cell, wherein the charge is accomplished by the application of direct current instead of a manual application of chemical charges as in the ordinary wet or dry primary cell, due to the fact that every metallic element in respective electrolytes has a certain electrochemical equivalent. The elements in a lead storage cell, namely lead peroxide and spongy lead in an electrolyte of dilute sulphuric acid, will give an electro-motive force of two volts on open circuit. Given a lead storage cell of two lead plates immersed in dilute sulphuric acid, a current of electricity can be obtained due to simple voltaic action, but the current will be dissipated in a very short time through polarization. If a direct current from an outside source be applied for a long period, the plate connected to the positive pole will become peroxidized, while the plate connected to the negative pole becomes spongy lead, and the density of the electrolyte rises until a point of saturation is reached, determined by the voltage of the cell not rising after continued charges. A lead storage cell is then considered fully charged. Upon connecting the terminal of the charged cell to a circuit of ohmic resistance, an electric current opposite in direction to the charging current is obtained. This current is direct in character. The cell elements undergo a chemical change to the extent that the oxide on the positive plate combines with the hydrogen of the sulphuric acid, decreasing the density of the electrolyte on account of water formation, and the SO_3 in the sulphuric acid electrolyte forms a sulphate on both positive and negative plates, until such a point is reached that the cell voltage drops suddenly, indicating that both plates have reached an equal potential difference, when the cell is considered discharged. The formation of lead sulphate, which is white substance, is such that having no conductivity, affords a measure relative to the limit of discharge. This measure is given as 1.7 volts as the limiting discharge point for the safe operation of a lead storage cell. Furthermore uneven formations of lead sulphate upon the plates causes uneven action and reaction upon the plates, resulting in the buckling and cracking of the plates and shortening the life of the plates.

Manufacture of Plates: Plates for storage battery cells are either of the Plante or pasted type. Inasmuch as the unit of rating of a storage battery is the ampere hour, the size of plate for a given capacity is thus determined. Practical experience has determined that 1.4 oz. of active material is necessary per plate to obtain a discharge capacity of one ampere hour. The standard Plante plates are principally manufactured in this country by two processes. The Electric Storage Battery Company of Philadelphia employ what is known as a Manchester plate, made up of an antimony grid with corrugated lead ribbon rolled into a close spiral and hydraulically pressed into the circular openings in the antimony plate. The Gould Storage Battery Company in its factory at Depew, New York, run molten lead into calendared plate sheets, then stamp out a plate of selected size, then spin the surface in oil, dry out the oil, leaving a clean spun surface ready for formation into a positive or negative plate.

The process of forming of the Manchester and spun plates, is one of chemical or electrochemical formation. The Manchester formation process is usually electrochemical in a dilute sulphuric acid electrolyte, while the spun plate is principally chemical in nitric acid.

The manufacture of the pasted type of plates is accomplished by manually or mechanically applying litharge to a lead antimony grid, and forming electrochemically. In the experience of the speaker it has been found that with pasted type of plates, a grid with excess antimony does not have the life of one with a limited amount of antimony. Another feature which is of importance in pasted plates is that the paste should have the proper moisture within it before being applied to the grid.

The Electric Storage Battery Company manufacture a pasted type of plate which is practically devoid of metallic grid. This type has vertical helical rubber tubes with the active material loosely packed

therein. The reason for using this plate is to obtain capacity, and it is possible to do this with this type because the active material is almost entirely loose in the helical rubber containers.

Another feature of pasted plates to accomplish longer life is the hardening of the plate. In this process the Gould Storage Battery Company has been exclusive in a secret process.

Installation of stationary types: Stationary types are usually installed in a battery room especially adapted for the purposes. This room is so constructed that the floors are usually of asphalt, with the walls asphalt painted. Ventilation is usually provided under a forced draft system accomplished by the use of a motor driven exhaust fan of a size depending upon the battery capacity and the room volume. Battery racks usually of two tiers, wood construction heavily creosoted or asphalt painted, are set up so that ample room is allowed for access for individual cell inspection.

The plates for the cells are usually shipped with positive and negative groups already assembled, it being modern practice to have an odd number of plates per cell, making one more negative plate per negative group, to obtain more capacity from the positive group. Connection between cells is accomplished by leaded bolts joining the strap posts in series that is positive group strap post lug of one cell to the negative group strap post lug of one cell. Connection from cell of one tier to that of another tier is done by leaded copper bus bars, or by leaded cables. Connections from battery or individual cells to the battery switchboard are made by sweating a lead covered cable into the plate strap lug, so as not to expose any copper and leading the cable into conduits or hanging on insulators, with a run to the switchboard.

In large stationary battery equipments, the plates are set into electrolyte in lead lined wood tanks, on glass insulators. In medium size stationary equipment the plates are set in electrolyte in glass jars set in sand trays which set on glass insulators, which set on the running board of the rack tier.

In assembling the plates into the lead-lined tanks or glass jars, the plates are first placed, then the rubber or wood separators are inserted between the plates and the electrolyte poured in, and allowed to stand for about 15 hours before a developing charge is applied.

In stationary practice the separators used are either of vertical ribbed rubber or bass wood placed into slotted dowels.

Installation of portable types: These types are those as usually used for automobile service, and are of the pasted type of plates. The plates are burned into straps making individual positive and negative groups and then 1/64 hard rubber sheets and ribbed bass or cypress wood separators placed between plates and the cell element then placed into a rubber jar, electrolyte poured in, allowed to stand for about 15 hours, then developing charge applied, cover sealed on, and cells mounted in hard wood trays, asphalt painted. The battery used for portable work requires an experienced lead burner. Lead burning is accomplished by the use of a clean oxy hydrogen flame. The hydrogen gas is made by the use of a specially adapted hydrogen generator. The oxygen is obtained from a receiver containing air under pressure.

Putting a battery into service and tests required: Practically the same procedure is necessary with Plante and pasted types of plates for the action is the same. With the plates and separators assembled in the jar, the electrolyte is then poured in after a test is made with a hydrometer to ascertain if the gravity is correct. In Plante cells the gravity of the acid is worked at a lower value than with pasted type cells because in the former ten pounds of acid per 100 ampere hours at the 8-hour rating is used, while in the latter or pasted type only about four pounds per 100 ampere hours are used. After allowing the plates to pickle in the electrolyte for about 15 hours, the developing charge of electricity is applied. This charge must equal six times and some times more, the eight hour ampere rating of the cell. If kept on without interruption, six times the rated capacity will be sufficient. To ascertain if the cell is fully developed, the following tests are made:

Gravity: A hydrometer is used to ascertain if the electrolyte gravity has reached a value of 1210 with Plante types and 1275 with pasted types.

Voltage: On closed circuit on charge the voltmeter should read 2.50 and stop rising with continued charge.

Cadmium: A round stick of cadmium covered with perforated rubber tubing is placed in the electrolyte. One end of cadmium is connected to the positive of the volt meter. The other pole of voltmeter is connected to a pointed phosphor bronze solid wire of about No. 4 gauge. When a cell is fully charged with cell voltage at 2.5, voltage between negative plate and cadmium should be from .16 to .2 volt.

Before placing the battery into service it should be discharged until reversal is reached and then placed immediately on charge and brought to capacity.

Discharge conditions: A cell should not be discharged below 1.7 volt because injurious sulphation takes place resulting in buckling. A cell is discharged when voltage is 1.7, electrolyte gravity about 1.144 in Plante type, and 1.147 in pasted type, and cadmium voltage is .25 in opposite directions to charge test.

Efficiency: The efficiency of a battery depends on the time elapsed from finished charge to start of discharge. In batteries where charge and discharge change rapidly, an efficiency of 90 to 91½ per cent can be reached. Where a long continuous charge is followed by a long continuous discharge the efficiency varies from 76 to 81 per cent.

Temperature: A battery should not be worked at a high temperature. Temperatures above 105 Fahrenheit are dangerous, and if reached the battery should at once be taken out of service and an inspection made to ascertain the cause. High temperatures on charge are due either to too high a charging rate or short circuited plates. High temperatures on discharge result from plate short circuits or from overloading.

Charging: When the rate is not known, allow six amperes per square foot of positive plate surface, and cut the rate down if the cell temperature rises 25 degrees Fahrenheit above starting temperature,

allowing for room temperature rise. Uusually the manufacturers furnish the charging rates with every type of lead battery. Good practice based on a 1000 ampere hour cell for eight hours, would be for charging as follows:

250 Amps. for 1 hour.
200 Amps. for 1 hour.
150 Amps. for 3 hours.
75 Amps. for 1 hour.
25 Amps. for 2 hours.

For rapid charging:

40 per cent of total for 1st hour.
25 per cent of total for 2d hour.
20 per cent of total for 3d hour.
10 per cent of total for 4th hour.

For quick charging:

50 per cent for 1st hour.
33 1/3 per cent for 2d hour.
16 2/3 per cent for 3d hour.

A good rule to follow is cut down the rate as soon as the cell gases freely.

Evaporation of electrolyte: There is always evaporation of electrolyte in a cell undergoing cycles of charge and discharge and the same should be replaced by distilled water, during charging. This is called flushing. The plates of a cell should be covered with electrolyte so that there is ½ inch of electrolyte above the tops of the plates at all times. An exposed plate will sulphate.

Taking a battery out of service: A battery should be given a full charge and then an overcharge, then the battery is discharged to 1.7 volts per cell and electrolyte drawn off and distilled water added in its place. Then each cell is discharged to zero volts. The water is drawn off, plates washed by flushing and then plates can stand until wanted for further service.

Application of lead storage batteries:

Standby service in central stations.
Voltage regulation on D. C. distribution lines.
To carry peak loads of central stations.
Voltage regulation in isolated building plants.
To carry load of isolated plant, when plant is shut down for the night.
To furnish country places with power where such places are off the line of central stations.
To furnish current for talking circuits in telephone service.
To furnish current for signal work.
To light trains in connection with a generator system.
To operate submarine torpedo boats.
For ignition starting and lighting on gas cars.
To propel electric pleasure and commercial vehicles.
To regulate long distance transmission lines.

Electro-chemical products are reported by the thirteenth census to be made in thirty-four establishments in the United States. The following table shows the 1909 production and values:

	Number of establishments reporting.	Quantity, tons.	Value.
Abrasives and electrodes	4	.....	1,415,799
All other	11	.....	2,953,649
Calcium carbide	4	60,973	$2,984,001
Caustic soda	5	19,428	1,032,647
Chlorates	5	5,785	904,550
Hypochlorites	5	45,976	1,506,831
Metals and alloys	9	.....	7,653,984
Total	34	.....	$18,451,461

"Metals and alloys," which made up 41.5 per cent of the total value, include aluminum, silicon, ferrovanadium, ferrosilicon, ferrotitanium and cuprovanadium.

LOS ANGELES AQUEDUCT DISCUSSION.

(Following is a letter addressed to the Oregon Society of Engineers regarding Mr. Chas. E. Warner's paper criticizing the Los Angeles Aqueduct (published in the Journal October 24, 1914). The Society refused to take any action on the letter The Editor.)

The systematic campaign to enlighten the public of the Northwest on the failure of the Los Angeles Aqueduct, is not inspired by any philanthropist motives, believe me. We might pass this effort on the part of our friends to save the people of other cities from the unpardonable sin of public ownership, were it not for the fact that the Los Angeles aqueduct was conceived, financed, and built entirely and wholly by engineers. When an attack is made on the aqueduct, it is a direct attack on the engineering profession.

The writer spent many years in water development in and around Los Angeles, and knows that the engineers of Southern California can get water where an Arab would die of thirst. They are the best posted water experts in the profession, and know the water situation from long experience. To say that the aqueduct was no necessity, but the result of scheming politicians, is too far from the facts, the writer knows, to be considered an unbiased opinion.

The cause for the construction of the aqueduct is very apparent to any one who has grovelled in the inverted river beds, drifted into the rocks, or stored the scanty winter rain water; any one who has done these stunts to get a few inches of water, knows the incentive and the cause of a popular cry for water in an arid land.

Water supply, and water distribution, is and always will be an engineering occupation. Financiering is not generally in his line. In the case of this great engineering feat, as in many great works of man, the engineer has had the financier to fight as well as the physical obstructions. He had in fact, to do the financiering himself. How well he succeeded in this radical departure from fixed customs can only be gathered from the facts as they now are.

The units cost is the crucial point. No matter what errors may have been committed in location, management or otherwise, the lineal foot cost of one of the longest conduits ever undertaken by man, is in actual operation, working, at a figure lower than any similar structure of present times. The writer knows nothing of the bad workmanship, malfeasance, or other mistakes said to have been made, nor does the quality of the water enter into the argument in the least. The water can be used, and the conduit does carry. That is evidence of success of the engineers. Low cost and efficiency; what more could you require? Nothing.

The water may not be the best. It may be too bad for domestic use, but it is good enough for irrigation, and incidentally for water power. There was nothing but praise from all sides for the undertaking up to the time the power possibility was urged as an asset to the city. Right there the trouble began. One hydroelectric company with an investment of ten millions, (the unit cost was not low, either) fearing the competition of the city, short-circuited the city bond sales in no time. They are still fighting public ownership. Whatever the merits or demerits of public

ownership may be, the public will finally determine. The point I wish to make is this: the reflection cast on the ability and integrity of engineers of the aqueduct; is not this a reflection on the profession? Are we not allowing ourselves to be exploited for the benefit of bond dealers in their campaign against public ownership? If you feel the same as the writer, you will send a note of congratulation to the men who are placing engineering where it belongs in the proper scheme of achievements.

Our profession is certainly in need of such men as those of the Los Angeles aqueduct. Perhaps the time for public ownership has arrived, and with it, the demise of the greatest possible mortgage value that can be handed to the same dear public to pay interest upon.

It is quite probable that the time has come when the public may see the difference between mortgage bonds based on municipal indorsements, and those bearing burdens of inflated values of monopolies. Who knows? With the new currency law, public ownership is more possible than ever. Should the engineer lend himself and his profession to thwart popular opinion? Should he as an individual or a paid servant, use the work of his fellows, to belittle and besmirch them in his zeal to shape public opinion? Is it better for the engineer to be a recognized man of affairs, or the faithful slave of a corporation? All these questions you must answer when you countenance the remarks designed to shape public opinion against public ownership.

Our aim is to add dignity and stability to our vocation; to promote our own interest by honest means, to our rightful place in society.

H. J. STOCKER.

Gresham, Ore.

LETTER TO THE EDITOR.

Los Angeles Aqueduct Mistakes.

Sir:—In your issue December 12th, Mr. Homberger of San Francisco expresses some interesting and to my mind, correct conclusions concerning certain difficulties of securing improved public service through municipal operation.

In his reference, however, to the Los Angeles aqueduct, he gives me the impression that he believes an important cause of the Los Angeles aqueduct failure to have been the opposition of power companies to its hydroelectric features.

As Mr. Homberger points out—the hydroelectric development was an afterthought. It was clearly, therefore, not the indirect cause of the following:

1. The planning of a 240 mile aqueduct, for a city of then approximately 160,000 people which already owned a supply of superior water sufficient for 1,000,000 people.

2. The unlawful seizure of the most important reservoir site by a private individual without protest from the city officials, thus making necessary the abandonment of annual storage and greatly reducing the dependable supply.

3. The adulteration of the cement with a clay which the adequate officials called tufa, thereby producing a concrete which did not harden under the conditions to which it was subjected and made serious breaks and expensive repairs a certainty.

Also it is beyond comprehension that any enemy of municipal operation could be capable of such Machiavellian intrigue as to cause the aqueduct management to adopt a system of accounting under which auditing was practically impossible; to lose 11 caterpillar traction engines and 12 trail wagons ($47,600 worth of heavy machinery) so effectively as to leave no record and no trace; or to adopt an inhuman plan of feeding, medical supervision and claims adjustment.

There are many other proofs that the aqueduct outrage and its subsequent failure were not due to any extraneous influences whatsoever. In fact, the best friends of honest municipal endeavor in Southern California join in condemning it, not only for the wrongs perpetrated on Los Angeles taxpayers and workmen but for its influence in discrediting honest efforts toward improvement of municipal conditions.

Very respectfully,

CHARLES E. WARNER.

MUNICIPAL OWNERSHIP AT SEATTLE.

Considerable space has been devoted by the daily papers of Seattle to the leaks which have developed in the new Cedar River dam. It is stated that the dam which was built by the city for its lighting department at Cedar Lake for the purpose of raising the level of the lake and increasing the power development for the city lighting plant at that point, has cost the taxpayers over one and one-half millions of dollars and was completed the first of last November. The dam is of concrete construction, about 200 ft. high and is built across the canyon two miles below the present crib dam, from which point penstocks take the water to the power house. The new dam was intended to raise the lake about 45 ft. above the present level of the old dam.

About two years ago, after the city had done considerable work in clearing the damsite, there was a great deal of discussion concerning the character of the north bank of the canyon and its ability to hold water. This bank was of gravel, formed through glacial action forcing the gravel up into a bank and creating the present river bed of the Cedar River, and dividing that river bed from the Snoqualmie water shed. Prominent engineers contended that the bank would not hold water, and as a result of this discussion, the city council appropriated five thousand dollars to pay three prominent hydraulic engineers to make an examination. In due course their report was submitted to the city authorities. The report strongly recommended further investigation into the character of the bank, and that test holes be sunk, and other steps taken to show whether or not the bank would hold water. They reported that in their opinion there was grave doubt as to the bank being of a character that would retain the water after the dam was built and water allowed to flow in back of the structiure. The report was filed away and the mayor, city council and lighting department decided that there was no necessity for further investigation and ordered contract let for completion of the dam.

The gates were closed at the dam and the basin allowed to fill up. After the level of the water had reached a point 34 feet below the present level of the lake back of the new dam, it was discovered that the water no longer continued to rise, although the entire drainage from the Cedar Lake basin was coming into the basin, and that it was seeping away at the same rate that it was flowing in. The leakage continued to increase until the basin is now discharging more water than is being furnished by the entire flow of the river. It now looks as though the dam would be utterly useless, and the only remedy seems to be to build a concrete wall for two or three miles along the north bank of the canyon. The cost of such a wall would of course be tremendous.

Report of Municipal Railway.

The accompanying tabulation showing a loss of nearly $6000 a month for the first six months' operation of the municipal railway does not include any charge for accounting or superintendence. This work has been done by the public utilities department and nothing charged up against the municipal railways for the service. No fire, damage, personal injury or employes' injury insurance fund has been provided. The services of the legal department have been furnished continuously to the railway department without charge as has also the services of the comptroller's and treasurer's departments. The time spent by employes of all of these departments represents a considerable sum of money. Where new employes are taken on and the time of old employes in these departments is given up to the work in connection with the municipal railways, their wages should be charged to the municipal railway in order that the taxpayer may be protected.

There was only one month when either Division "A" or "C" showed an excess of receipts from traffic above the bare operating expenses, exclusive of interest and other fixed charges as will be seen by the following table. Division "C" showed an excess of $145.21 in the month of July:

SEATTLE MUNICIPAL STREET RAILWAY.
Operating Expenses and Earnings From June to November 30, 1914.
Operating Expenses.

	June.		July.		August.	
	"A."	"C."	"A."	"C."	"A."	"C."
Way and Struct.	$ 137.60	$ 10.82	$ 67.78	$ 35.44	$ 78.00	$ 83.76
Equipment	75.41	.....	129.05	66.30	105.02	35.68
Equipment	.....	.....	11.61	14.06	26.35	15.39
Power	955.00	813.56	993.80	825.70	972.41	828.50
P. Cond. and Mtrmn.	985.59	954.54	993.76	861.04	991.37	855.23
F. Cond. and Mtrmn.	.....	17.81	.....	46.31	.....	50.25
Carhouse Emp.	425.25	18.29	279.25	61.18	279.19	65.06
Other Trans. Emp.	62.50	134.94	62.50	132.76	62.50	117.76
Other Trans. Exp.	12.68	8.55	38.09	7.50	32.72	57.61
General and miscellaneous	3.15	505.40	9.65	470.20	.....	465.00
Total	$2,657.18	$2,463.91	$2,585.49	$2,521.19	$2,547.56	$2,514.24

	September.		October.		November.	
	"A."	"C."	"A."	"C."	"A."	"C."
Way and Struct.	$ 81.38	$ 169.80	$ 31.81	$ 293.47	.....	.....
Equipment	60.57	146.72	170.70	43.90	.....	.....
Equipment	6.15	.....	12.20	.....	.....	.....
Power	929.00	803.00	670.00	570.00	.....	.....
P. Cond. and Mtrmn.	919.34	793.69	900.98	780.06	.....	.....
F. Cond. and Mtrmn.	.....	52.87	.....	61.13	.....	.....
Carhouse Emp.	270.94	84.01	280.51	91.13	.....	.....
Other Trans. Emp.	31.25	145.25	96.20	124.25	.....	.....
Other Trans. Exp.	58.37	26.57	35.04	6.14	.....	.....
General and miscellaneous	.....	500.06	.....	508.88	.....	.....
Total	$2,357.00	$2,722.27	$2,197.44	$2,478.96	$2,804.82	$3,146.49

Earnings.

	June.		July.		August.	
Passenger revenue	$1,346.02	$1,886.13	$1,482.54	$2,065.87	$1,436.93	$1,774.24
Freight revenue	.....	25.00	.....	107.15	.....	120.05
Miscellaneous revenue	466.67	8.33	481.67	11.71	481.67	8.33
Total	$1,812.69	$1,919.46	$1,964.21	$2,184.73	$1,918.60	$1,902.67

	September.		October.		November.	
Passenger revenue	$1,307.73	$1,190.64	$1,226.79	$1,127.61	$1,118.05	$ 937.88
Freight revenue	.....	87.20	.....	140.80	.....	111.90
Miscellaneous revenue	466.67	8.33	481.67	8.33	466.67	8.33
Total	$1,774.40	$1,286.17	$1,708.46	$1,276.74	$1,584.72	$1,058.11

Operating expenses, Division "A," from June to November 30			$15,049.49
Operating expenses, Division "C," from May 23 to November 30		$15,847.06	
Less book charge rental of cars, Division "A"		2,845.02	13,002.04
Total operating, Divisions A and C (no interest on other fixed charges			28,051.53
Revenue, Division A, June 1 to November 30	$10,763.08		
Less book credit for car rental	2,845.02	7,918.06	
Revenue Division C, from May 23 to November 30		9,627.88	17,545.94
Loss			$10,505.59

Loss from operation to November 30, 1914	$10,505.59
6 months' bond interest on $300,000 at 4½ per cent.	6,750.00
Interest on $75,000 borrowed from Garb. Fund and $9,000 from G. F., at 4½ per cent.	1,890.00
6 months' taxes on $375,000 invest. Division "A," basis 45 per cent val.	3,750.00
6 months' deprec. at 4 per cent on $375,000 plant cost Division "A"	7,500.00
6 months' int. on $27,500 at 4½ per cent borrowed from G. F. for Division "C."	612.00
6 months' taxes on $150,000 inv. Division "C," basis 45 per cent valuation	1,500.00
6 months' deprec., 44 per cent on $150,000 plant, account Division "C"	3,000.00
Total loss, 6 months, "A" and "C"	$35,507.59

	June.		July.		August.	
	"A."	"C."	"A."	"C."	"A."	"C."
Expenses	$2,657.18	$1,997.24	$2,585.49	$2,039.52	$7,547.56	$2,032.57
Receipts	1,316.02	1919.46	1.482.54	2,184.73	1,436.93	1,902.67
Deficit	$1,311.16	$ 77.78	$1,102.95	$ 145.21*	$1,110.63	29.90

*Surplus.

	September.		October.		November.	
Expenses	$2,357.00	$2,255.60	$2,197.44	$1,997.29	$2,804.82	$2,679.82
Recepits	1,307.73	1,286.17	1,226.79	1,276.74	1,118.05	1,058.11
Deficit	$1,049.27	$ 969.43	$ 970.69	$ 720.55	$1,686.77	$1,621.71

The receipts from passenger traffic of Division "A" have fallen off from $1482.54 in the month of July (the highest) to $1118.05 for the month of November, and for Division "C" from $2184.13 (the highest) to $1058.11 for the month of November. While the operating expenses exclusive of interest and other fixed expenses have varied from $2197.44, the lowest in any one month for Division "A," to $2804.82, the highest, for the month of November, and for Division "C" from $1997.24 in the month of June to $2679.82 for the month of November. The receipts from the traffic of neither division are at present sufficient to pay the wages of motormen, conductors, carhouse and transportation employes.

Veto on Extension Bill.

Mayor Gill in his veto message accompanying the unsigned municipal light extension bill returned to the council, characterized the measure as socialistic, giving an opportunity for "certain persons to settle grudges arising from real or imaginary grievances against a private corporation." He sets forth at length what he believes to be the legitimate purpose of a municipally owned utility. The extension of the light and power system outside of the city limits to Tukwila and Foster is not within the pale of legitimacy, he says, and, if necessary, he will take issue with the council on the extension if the bill is passed over his veto.

In the closing paragraph of one of the longest veto messages Mayor Gill has ever penned he makes it clear that as long as he holds teh executive's chair the department will confine its operations within the corporate limits of the city.

Mayor Gill says that the city is not properly lighted; that taxpayers in some cases have had to put in their own wire and poles to get electrical service from the city, and that the department should turn its attention to the needs of those within municipal boundaries, light up the alleys and add another penstock from the Cedar dam.

MUNICIPAL OWNERSHIP OF WATER WORKS AND SUPPLY AND OF HYDROELECTRIC POWER PLANTS.

BY E. F. SCATTERGOOD.

A contributor to the December 12th issue of the Journal of Electricity, Power & Gas, who, in the innocence of youth, has failed to penetrate or comprehend the significance of certain articles, of comparatively recent date, appearing in the Journal, appears to have reached the conviction that municipal ownership of hydroelectric power plants is absolutely without justification, and that the advisability of a city owning its own water supply and distributing works is very questionable. The completed aqueduct project and partially completed hydroelectric power works of the city of Los Angeles are cited as the basis of warning to the city of San Francisco regarding such municipal undertakings.

Three essentials to the prosperity and growth of a municipality or a community are an ample water supply at a reasonable cost, adequate transportation at low rates, and cheap electric power of a reliable character. Where these three are combined, such growth is assured.

As bearing on the advantages of a municipally owned water supply, it should be observed that the city of Los Angeles has owned its water system for something over 12 years; that during that period the rates for water service have been but approximately one-half, or less than one-half, the average rates for such service in the cities of Oakland and San Francisco, for example, under private ownership and public regulation. At the same time the city of Los Angeles has practically rebuilt and extended its local water system and supply out of the earnings and the total outstanding liabilities, or bonds, are less than $2,000,000, while the city of San Francisco is at this time facing an expenditure of $35,000,000 for the purchase of the existing local water system and supply.

Ownership by the city of Los Angeles of its water supply and system has made it possible to reach out and secure a permanent and ample supply of pure water, at reasonable cost, for the future. It has become an accomplished fact through the completion of its aqueduct, leading from the Owens Valley, and the benefits resulting from such guaranteed water supply have already more than repaid the property owners for the expense to them of the undertaking. San Francisco unquestionably should realize similar benefits from the carrying out of its proposed Hetch Hetchy project.

It is true that the completion of the proposed hydroelectric power system of Los Angeles has been delayed something like two years owing to the opposition of private interests, who are unwilling to sell their existing systems to the city at a valuation made at this time by the railroad commission, or otherwise. However, the merits of municipal ownership of hydroelectric plants, as well as of a water supply, become apparent by a further comparison between conditions existing in Los Angeles and San Francisco. While in Los Angeles, as a result of the stimulating effect of municipally owned hydroelectric plants, which are as yet but partially completed, we are enjoying a 5½c base rate for electric light service and a very much lower base rate for power service, without such a thing as a contest in the courts being mentioned, in San Francisco, where public regulation exists without municipal ownership of such power plants, they have not been successful in establishing rates anywhere near as favorable to the consumer, although they have attempted to do so; have had the benefits of comparison with the rates in Los Angeles, and, at least, should have had the benefits of the existence of abundant water power comparatively near the city.

Remembering, then, that a reliable water and power supply, at low rates, are two of the three essentials to the fullest development of a community, there appears to be no reason why the city of San Francisco which is to be congratulated upon its successful handling of the local transportation problem, should hesitate or give ear to any warning against proceeding with its proposed ownership of water works and supply and of a hydroelectric power supply.

OREGON HYDROELECTRIC CONFERENCE

The annual session of the Oregon Hydroelectric Commission was held December 12th during the Commonwealth Conference at Eugene. The chief subject for discussion was the proposal that hydroelectric power districts be established.

The meeting was called to order at 9:30 a. m. by Hon. H. B. Miller, chairman of the commission. An outline of the proposed measure, which had been prepared by John McCourt, was read by Secretary W. D. B. Dodson. The plan is to divide the state into hydroelectric districts which are to be bonded for the development of electricity from the natural water power. Each district is to be vested with the power to acquire and develop water under the plan of the Wisconsin indeterminate franchise, under the regulating jurisdiction of the railroad commission.

A paper on "Hydroelectric Problems in Oregon" was read by Charles E. Warner. W. H. Crawford presented a strong plea for the enactment of laws which will make possible the formation of hydroelectric districts. Both of these papers are published in this issue.

During the afternoon session J. L. White gave a paper on "Electricity in Rural Districts" and H. L. Vorse read a paper prepared by Dr. J. F. Watt to show the need for a district hydroelectric law. Senator L. B. Huston spoke regarding national regulation of hydroelectric power and was appointed a committee of one to draft and send a resolution to Oregon's senators in Congress to hold up the Ferris bill until certain changes could be made in it.

General discussion then held sway for two hours. Those taking part were: W. D. B. Dodson, Secretary Clyde B. Aitchison, State Utilities Commissioner C. E. Warner, Porter J. Neff, H. L. Vorse, member Hydroelectric Commission; Professor F. G. Young, Wm. H. P. Hill, Northwestern Electric Company.

As a culmination of the afternoon's discussion, a motion was made by Charles E. Warner, consulting civil engineer, that a committee of three be appointed by the chair to frame the suggestions made in the conference concerning the formation of hydroelectric districts. The committee is to work with the Oregon Commission that a proposed act may be submitted to the legislature next month. Mr. Warner's motion carried, and C. P. Bishop of Salem, S. B. Huston, State Representative-elect, of Portland, and Charles E. Warner will serve in that capacity. As a result at the next session of the legislature a bill will be presented to provide for the incorporation and organization of public utility districts to incur bonded indebtedness for the purpose of the construction of works and the acquiring of property, and to levy and collect taxes to pay the principal and interest on bonds for the carrying on of these operations and to provide for the powers, management and government of such districts.

THE HYDROELECTRIC PROBLEM IN OREGON.

BY CHARLES E. WARNER.

To many, the hydroelectric problem of Oregon seems a simple one. We have large streams with falls and rapids. Take the difference in elevation and the quantity of water, make the proper multiplication and divisions and there you are 3,000,000 horsepower. Now issue as many bonds as the people will vote, and build a few large hydroelectric plants at the expense of the taxpayers and there you are. The only practical part of the above is its termination—"There you are."

The "wonders of electricity" have a tendency to make men dream. Electricity is so intangible. It can be measured or estimated only on a basis of pure theory confirmed by the fact that the theory fits when practically applied. Electricity can not be seen and it is extremely difficult for the average person—even of the well informed—to get anything but the most hazy impression of a thing he cannot see. Therefore when high-sounding statements are made in the press or from the platform about the wonderful results obtainable through the development of large quantities of electric power, most people are inclined to fall under the spell and accept the prophesy of miracles without putting the prophet to the test of analysis.

Out here in Oregon we are especially tempted to imagine great things. The whole country is big and its features are grand and when we are told that we have 3,000,000 horsepower of undeveloped water power and that this power places the command of the industry of the world in our hands, it is easier to believe than not.

Fortunately for Oregon, many of us possess an idea of balance and are able to relate one set of figure to another and to consider that it takes more than one element to make industrial success.

Sets of figures mean very little until analyzed by men possessing practical knowledge of their application and significance.

There must be estimates and tabulations, however, as a basis of determining facts and as the public at large cannot of necessity be experts on all subjects, the only statements that impress the public are those which express striking ideas in a few words or figures.

Three million horsepower embraces a great deal in four words. In its practical significance to this generation, however, it may mean much or little according to the comparative wisdom exercised by the people of Oregon, with the consent of the U. S. Government, in considering the practical utilization of so much of that power as may economically be developed for such utilization. In this sense we may be limited to 1,000,000 horsepower, still a large figure, or we may be limited to an extremely small power over which we could not enthuse at all.

Nowhere in the world is the relation of physical and intangible values better illustrated than in this latent water power of the Pacific Northwest. For some years there has been a tendency in the United States to develop a line of thought started in those thickly populated centers of the East where almost any sort of raw material has a positive value—the line of thought which establishes physical value as the only real value of a property. There is hardly any conception so false, however, as this distortion of the relative importance of physical value. Strictly speaking there is no such thing as physical value. The coal in the ground or the tree in the forest has no value until coupled with the intangible value of men's abilities. The value of the lumber or the steel rail or the hydroelectric plant is physical plus intangible value and from the time the raw material begins to be used, that which increases its value is altogether the brain power of men applied through the labor of other men and through machinery built by men.

In New England water power is money. The home market is there for industries in which power is an important factor. Also fuel is expensive. The policy of the United States in conservation is dictated largely by Eastern men who have small conception of or interest in the water power problems of the West. It has been hoped that the able Californian who is now Secretary of the Interior will help to make Western water power development more encouraging than at present.

In any event, we face a problem in Oregon entirely opposite to that of the East. They have the home market for industrial products. We have undeveloped power. Our undeveloped water power is a basis of hope for the future, but it must have a market and there are just two ways to get

that market. We may build up a home market through pump irrigation; a more liberal system of farm credits; and a comprehensive colonization plan. We may also develop a few industries which will consume large quantities of electric power and will produce goods on a cost basis that will enable them to compete on favorable terms in the markets of the world. In either case our problem is not one of power development. It is one of careful research to find what kind or kinds of market we can develop for the power now available in quantities far ahead of present demands.

I am not here to plead for corporations. But it is a strange condition in which some electric corporations find themselves today, being between regulating officials, on one hand, who criticize them for too much development, and on the other hand, the threat of more power being developed in an already saturated market.

I am glad to see the hydroelectric commission endeavoring to find some means of extending the market for electric power. That is the most important thing that can be done.

Oregon and California have each about 3,000,000 horsepower of undeveloped water power. Washington has 5,000,000. These are government estimates. All this power is in competition with other kinds of power and with other localities. Norway develops power by a combination of government ownership and private operation at low cost. Other localities are more favored in raw materials than we are. Also we have a great deal of power developed in Oregon from sawmill refuse at a cost which puts waterpower out of competition except under the most favorable conditions. All these elements combine to add to the burden of our difficulty in making a practical application of our great power. This is the negative side of the situation, but it must be considered.

On the other hand, we have vast areas of good soil. Under much of this soil lies water at reasonable depth. In all of Oregon, irrigation has some value and pump irrigation will greatly benefit the state. There are many other farm uses of electricity which will be referred to by another speaker. I only mention this phase of the subject in a general way as a cause for optimism.

Then we have an inland seaport 100 miles from the ocean—an ideal location for gathering a variety of inland products for ocean shipment. Reaching inland from that port are about 2000 miles of river which is partly navigable and now gives water grades for railroads. All this 2000 miles will become navigable and we shall be able to assemble raw materials from British Columbia, Idaho, Washington, and Oregon to build up at Portland one of the great manufacturing centers of the West. This will take time but it is coming and the rapidity of its approach will depend upon the wisdom and industry of the people of Oregon. We ought to make up our minds to bend every effort toward a consolidation of government and private enterprise in solving this hydroelectric problem. We ought to get every one in Oregon working together and the more help, financial and otherwise, we can get from outside the state on a fair basis to all concerned, the better. We want all the help we can get on fair terms.

THE DEVELOPMENT OF STATE BUSINESS.

BY W. H. CRAWFORD.

The state of Oregon is just a big business institution. It in a corporation in which we are all stockholders. It is an enterprise owning about 100,000 square miles of mountains, valleys, plains, desert country; rivers, power streams, coast line, forests and fertile fields, less a large area held as Forest Reserve. The stockholders are 750,000 fortunate human beings. Broadly speaking, the business of the state is to make its stockholder comfortable, happy and prosperous. We get no cash dividends on our stock, in fact we pay assessments all the time. Hence our profit must appear, indirectly in our special field of endeavor.

There are two broad divisions in the analysis of every business enterprise; the internal construction and management of the company itself, and the external relationship of the company with the outside world. Or we might say Production and Sales. Both departments are very important. If production is faulty there will soon be no sales, and if sales are neglected the company will fail, no matter how perfectly organized the production may be.

In the business of state, we find the same weakness that prevails in corporation and individual life. Usually, more attention is paid to the internal productive end, than to the external market and of the business. The part that is nearest to us receives most attention. The state is almost exclusively concentrated on the production and management of its business, at the expense usually of the sales end. We have laws, commissions and institutions all designed to make smooth the internal operations of our big corporation, but how much business getting machinery?

A very natural question at this point might be "What has the state to sell?" If we agree that the dividends are to be comfort, happiness and prosperity to the stockholders, then anything that the state can do in the way of selling, or serving, or giving that will pile up dividends for the stockholders, is the state's business.

Oregon has a railroad commission handling utility matters. It is designed to insure to the people, and to investors, fair play, but it cannot help to push business. It acts as a court of justice, in matters of dispute that have no standing in regular courts, because the law has not yet made crimes of those particular disputes. When luxuries become necessities in the march of civilization, then we are inclined to handle them in order to accomplish the greatest good for the greatest number.

Similar commissions in other states have more or less power, but none that reach beyond the internal, managerial end of the state's business. Attempts have been made from time to time to push business in an official way. The Georgia Chamber of Commerce has a committee on water power development whose purpose is to enlighten the farmer on uses of electricity; to reach out after manufacturers and to initiate useful legislation along these lines. Illinois has 100,000 h. p. water shed on the Illinois River which it will market if possible. The Sanitary District of Chicago has 28,000 h.p. developed (48,000 h.p. still undeveloped) which it sells to the city of Chicago at cost. New York State has 1,250,000 h.p. of undeveloped water power which it is trying to market, bills having been before the legislature since 1911 proposing to create a commission with power to purchase, develop and sell electric current to municipalities or districts.

In Ontario, Canada, a measure was passed in 1906 creating the Hydroelectric Power Commission. This commission has the function of business getting. It can buy or generate power and sell it to municipalities or districts or to individuals. It started in by purchasing current in large lots from the Ontario Power Company, at Niagara Falls for $9 per h.p. per year. It delivered this in smaller lots, over its own lines, to the doors of various cities in Ontario for prices ranging from $18 per h.p. per year, and upwards, depending on the cost of delivery. Today this commission serves over 2,000,000 people with 50,000 h.p. The cost of service to the community has been reduced about one-half of what it was on old basis and the demand increased so that today the current consumption per capita is three times greater in Ontario than in New York State, just across the St. Lawrence River.

Right here let us turn our attention for a moment to the United States, and make a comparison between the East and West. Suppose we draw a line straight up and down on the eastern border of Montana and Arizona. This would cut the United States in two, with ¼ of our territory lying west of

the line and ¾ lying east of it. Six per cent of our population would be west of the line and 94 per cent east.

The electric current consumption per capita per annum West is 527 kw. hr. and East 99 kw. hr. In other words, while Ontario exceeds New York State, three to one (with similar conditions and equal opportunities) the Western quarter of the United States exceeds the Eastern three-quarters by over 5 to 1. This cannot be used to prove anything, without further analysis, excepting the fact that heavy investments have been made in our Western country regardless of the market.

The investment per capita in power generation and transmission machinery is $7.50 in the Western quarter and $3.00 in the Eastern three-quarters, Oregon having about twice $7.50 per capita.

The Ontario Commission was a bold step and apparently a wise one as it seems to have proved out its practice, although we cannot say that this procedure will fit every case.

Local conditions must always be considered. In Oregon we have a great surplus of power already developed and on the market waiting for purchaser. This condition is almost uniform throughout the state. There are of course a few places where people want to buy current and cannot get it. (We have an easy remedy for this). There are also hundreds af alluring water falls that have not been developed and seem to tempt us with their song of cheaper power. Then we have that golden opportunity for power development in connection with sawmills as at Marshfield, Astoria and Springfield.

Now for the question: In this big business corporation of Oregon, what can we do at our next stockholders' meeting with reference to our next session of the legislature, or directors' meeting if it carries out the simile any better, to insure bigger dividends? I have some suggestions to make that are very temperate, very modest, but very necessary. They relate both to the productive and to the market end of our business.

First: I want the powers of our able railroad commission broadened to cover municipal utilities as well as private corporations. Municipal utilities must be under regulation if the work of the commission is to be efficient.

Second: I want to make it possible for rural districts and municipalities to combine, or for districts alone to organize for the production, purchase, transmission and sale of electric current, where it is impossible to get proper service from other means at hand. And I want these districts to get their permission to organize, and to operate from the railroad commission, and to be governed by it, just as private corporations do now.

Third: I want the private corporations who have invested their money here in the western part of the United States to the extent of $7.50 per capita, and in Oregon to an amount about twice as great, to prosper. Their electrical development is far in excess of present requirements in most places, hence their load curve poor and revenue unsatisfactory. We should help them build up their load curve; to find a market for their product, so that further market can be found for further product. Their success is our success, remembering that we now have a court of disputes in the railroad commission, if we should be dissatisfied with anything.

The commission (if properly empowered) will protect us from injustice and will protect one investor against the evil acts of another investor. As stockholders in the great business of Oregon, we will enjoy better dividends if we recognize the advantage of helping along the market end of our enterprise.

Our wonderful water falls are far better unharnessed, than that good money be spent to make them work before we have a proper market to absorb the product. This folly would place 3 h.p. where 2 h.p. are now offered to do the work of one.

Under these conditions somebody will suffer and none can profit long. So my third proposition is to develop our market, to educate the individual consumer, before we spend any more money on new plants, and before we let any one else spend more money.

When you hear the suggestion I would make, showing how the state can help the market end of the business, please remember that private corporations are doing this all the time. But they have found that when they go to the individual in their desire to educate him and increase the use of current, the individual has a little problem of his own.

My first and second suggestions are up for immediate action. These are all following suggestions and predicated on the broad principle that when the state as a whole is on a highly efficient sales basis, the coming of new industries and the further development of our power sites will follow as a natural consequence, in the right way.

PANAMA-PACIFIC A. I. E. E. CONVENTION.

Mr. H. A. Lardner, who was chairman of the Pacific Coast committee of arrangements for the postponed International Electrical Congress, has received word from Secretary F. L. Hutchinson of the American Institute of Electrical Engineers that at a recent meeting of the Board of Directors of the Institute it was decided that the San Francisco convention of the Institute next year should be held in September, during the week originally decided upon for the International Electrical Congress; or, in other words, during the week immediately preceding the International Engineering Congress.

The decision was reached principally on account of the fact that the Institute is joint host with the other national engineering societies in arranging for the International Engineering Congress, and also because we have learned that the American Society of Civil Engineers is to hold its annual convention in San Francisco during the week preceding the Congress, that the American Institute of Mining Engineers is to hold its midsummer meeting either during that week, or during the week of the Congress, and also that the American Society of Mechanical Engineers will in all probability hold a special meeting in San Francisco approximately at the same time.

OREGON IRRIGATION CONGRESS.

The Oregon Irrigation Congress will be held at Imperial Hotel, Portland, Oregon, January 7, 8, and 9, 1915. This session will open with an address of welcome by Mayor H. It. Albee, after which there will be an informal discussion on business. No papers to be read. Only oral speeches which will be limited as regards time. All discussion to be oral also. Formal papers may be submitted in the form of reports to be used in the printed proceedings.

In the evening a banquet will be given by Portland Commercial Club to the delegates. The speakers will be Governor-Elect James W. Whitycomb, Hon. Duncan Marshall, Minister of Agriculture, province of Alberta, Edimston; O. Laurgaard, Project Engineer, Tumalo Irrigation Project. "Report of Work Accomplished by the Oregon Irrigation Congress." Attorney General of Oregon (Elect) Geo. M. Brown, short talk; M. J. Kerr, President O. A. C.; E. G. Hopson, U. S. Reclamation Service; E. L. Thompson, (Hartman & Thompson Bank), Chairman Commercial Club Irrigation Congress.

On January 8th in the morning, Hon. Duncan Marshall will give an address, followed by discussion from delegates, and in the afternoon the report on legislative work of the Irrigation Congress will be read by J. T. Hinkle, Ex. Secretary Irrigation Congress. A brief address will be made by Geo. M. Brown.

On January 9th there will be addresses by C. L. Smith, agriculturist of the O. W. P. & N. Co.; Geo. T. Cockran, Water Division No. 3 Superintendent, La Grande, Oregon, and Herbert D. Newell, Project Engineer, Hermiston, Oregon.

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Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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Turning the Page

Before turning the page to the year to come it is of interest and value to look over the page of the year which is now rapidly drawing to a close. Most prominent is the black picture of war, reaching out with greedy fingers to draw all civilization down into the maelstrom of destruction. While we of the West are far from the scenes of battle we sympathize with the misfortunes of others and rejoice in our own comparative peace and security.

Yet the war, by tightening the money market, has had a depressing effect upon all engineering construction. This has been reflected by a decrease in new work and has resulted in laying off many able men.

The financial stringency has been intensified by the hostile attitude of the government toward business. The gloomy prophesies of the effects of the conservation policy have been verified. Men hesitate to invest in hydroelectric securities made insecure by governmental threat. The immediate effect, also, of some of the public service commissions, has been to inspire doubt as to their ultimate intentions. Governmental competition in such public service as communication or power generation, does not stimulate confidence in private holdings.

Without money, engineering ability and opportunity are of no avail. As a consequence, most of the engineers of the West have been marking time during the past year. Many have had a chance to finish some long cherished plan and a few have had opportunity to rest, something not possible in the feverish activity of the previous decade.

This somber picture of the past makes the future appear all the brighter by contrast. Each element which contributed to past weakness will prove of future strength. The inevitable reaction of the European war will be to boom American business. President Wilson gives assurance that business need have no further fears as to what Washington may do. Added stability has been given to public utility issues which have been passed by the commissions. Even timid capital is beginning to realize that cause for alarm is passing and business men are now saying "business is better."

As we turn our eyes to the future every prospect is bright for renewed Western prosperity. Thousands upon thousands of visitors will view the wonders of the West for the first time while on their way to and from the Panama-Pacific International Exposition. Interest will be aroused in the opportunities for development of our great natural resources. Renewed interest is being taken in mining, fisheries are declaring big dividends, the farmer has received good prices for large crops, ample water is already assured for irrigation and hydroelectric operation, and every substantial reason exists for optimism.

Nothing can be accomplished by regretting that 1914, like the rushing waters hurrying to the ocean of oblivion, was not more efficiently utilized in driving the wheels of progress. The old year has already been made obsolescent by the promise of the new. Heed the lessons learned and apply the experience gained in the design of the new year.

These mutations of time which we commemorate are but arbitrary measurements of duration. There was no old year and will be no new in the infinite stream with which out finite minds are momentarily in contact. This new year will be like other years with its complement of success and failure, hope and disappointment, joy and sorrow. Only let it be remembered that the discovery of the future is based upon the records of the past and every Journal reader will enjoy that "Happy New Year" which it is our pleasure to extend at this season.

The Evils of Price Cutting

Although attention has been called many times in these columns to the injustice and inequality of the Supreme Court decision which forbade a manufacturer from naming the price at which his product should be sold to the consumer, time has not yet provided a relief, nor has it softened the hardship. Its effect in the electrical business is particularly demoralizing and is largely responsible for the lack of harmony between the central station and the dealer. The central station does not know at what time it will need the friendship of the electrical contractor and dealer as an advocate at the bar of public opinion, nor does it realize how the practice of cutting prices on electrical devices is estranging the dealer. To legalize price maintenance would at least remove the temptation to cut prices.

Price maintenance does not mean price-fixing, nor does it strengthen monopoly. It raises competition from a cut-throat struggle of price against price to the higher level of quality against quality and service against service. It preserves for the manufacturer the market he has created by legitimate sales effort, it protects the retailer against unfair competition of other retailers and gives the consumer standard quality at standard prices. The benefits of price maintenance may be emphasized by considering the evils of price cutting.

Price cutting pre-supposes that a fair standard of quality and of price has been set by extensive advertising, as otherwise there would be no inducement to cut the price. It causes doubt in the purchaser's mind as to the value of the article; it injures the name of the article and is maker; it lessens the demand, and if not checked finally ruins the market. A cut price is not a leader but a mis-leader.

We all realize the necessity for standards. We all believe that confidence and service are the basis of trade. We know that success is the science of being believed in. Yet whenever we sell or buy an article at a cut price, except under extraordinary circumstances, we are tearing down the foundations of successful merchandizing, a structure which has gradually evolved from the primitive policy of the ancient Romans, "caveat emptor" (let the buyer beware) through the struggle to assure one price to all, and finally to the pinnacle of the national reputation and the established selling price which result from judicious publicity.

The courts should not be held responsible for this state of affairs, as they are only interpreters of the law as it exists. A new law is needed to legalize price maintenance. Such was the purpose of the Stevens Bill which was introduced at the last session of congress and now is "in committee." Strong opposition was developed against its enactment by big interests and it may be that the present session of congress will also adjourn without passing this needed measure.

Some hope has been expressed that the new Industrial Trade Commission, which assumes its duties with the opening of the new year, will give more immediate relief. Where price cutting can be shown to be unfair competition and in restraint of trade, this commission will be empowered to put a stop to the practice. Be this as it may, there is still need for a definite prohibition of this pernicious practice.

The War for Municipal Ownership

A great war is being waged for municipal ownership of public utilities, with the Pacific Coast as the battle-field. The columns of this journal have frequently been devoted to this question, space being given to both sides in the controversy. Every endeavor has been made to present data from every standpoint so that the readers may be in a position to decide for themselves as to the merits of the case.

A technical magazine, such as the Journal, should maintain a position of strict neutrality, being a mirror rather than a molder of public opinion. Several times during the past four or five years the opinion has been editorially expressed that the theory of municipal ownership is excellent, but that the practice of political operation is poor. But the main question in itself, is still far from being decided.

Elsewhere in this issue, for example, Mr. E. F. Scattergood and Mr. H. J. Stocker defend the Los Angeles aqueduct against the attacks which have been made on it. Mr. Chas. E. Warner, on the other hand, repeats certain accusations which have not yet been explained or denied. Another article presents facts and figures about the situation in Seattle.

Further comment from our readers is invited on these subjects. No interpreter has been able to determine whether "municipal ownership," the handwriting on the wall, is warning or prophecy. Eventually the matter will resolve itself into a determination of the greatest good for the greatest number.

Today the result of all this agitation has been to retard private initiative and capital in the public service. The situation has become so serious in Oregon, whose many natural resources are largely undeveloped, that a conference was held at Eugene last week to provide a plan of hydroelectric districts similar to the irrigation district. This latter plan, while it may be of assistance in developing a territory, should be carefully safe-guarded so as to be sure that it is not being used to the detriment of those private parties who are already doing all in their power to develop those resources.

The equation of municipal ownership is one containing several unknown quantities. The approximate solution which can be found by observation does not satisfy many people, and it is only by the slow and costly method of actual trial that the answer will ultimately be found.

PERSONALS

Albert Sechrist, electrical contractor of Denver, Colo., has been spending the past week in Seattle.

J. Baugh, an electrical contractor of Petaluma, Cal., was a visitor in San Francisco during the week.

A. Turkhill of the Reedley Electrical Works, Reedley, Cal., spent several days during the week in San Francisco.

Thomas Finigan, vice-president of Pierson-Roeding Company, has returned to San Francisco from an extended Eastern trip.

W. F. Detert has been elected president of the Northern California Power Company, and **H. H. Noble,** chairman of the board of directors.

Guy H. Talbot, president of the Portland Gas and Coke Company and Pacific Power and Light Company, spent a few days in Seattle recently.

H. V. Carter, president of the Pacific States Electric Company, has returned to San Francisco from the electrical jobbers' convention at Birmingham, Alabama.

C. B. Hall, manager of the Illinois Electric Company of Los Angeles, attended the Wass Hael at San Francisco on December 19th, after leaving the jobbers' convention at Del Monte.

J. G. De Remer, formerly chief engineer with the United Light and Power Company at San Francisco, is now associated with the American District Steam Company at North Tonawanda, N. Y.

Alex Taylor, manager of works, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., who is making a business trip on the Pacific Coast, arrived at San Francisco during the past week.

W. R. Lyall, Pacific Coast representative D. & W. Fuse Company, San Francisco, returned during the week after an extended business trip which embraced all the leading commercial centers of the Pacific Coast.

A. H. Babcock, electrical engineer for the Southern Pacific Company, and **A. G. Jones** of the General Electric Company, have returned to San Francisco from Tucson, Arizona, where the Arizona Railroad Commission approved the electric headlight being used by the Southern Pacific Company.

W. R. Putnam, new business manager of the Utah Power & Light Company, with headquarters at Salt Lake City, is making a trip through the Northwest, visiting Portland, Seattle, Spokane, and other points for the purpose of studying new business and operating practices of companies in that territory.

Chas. E. Warner, author of the paper on the Los Angeles Aqueduct Mistakes recently published in this Journal, is a consulting engineer with offices in the Electric Building, Portland, Ore., He was formerly chairman of the Los Angeles Aqueduct Investigation Board and member of the Los Angeles Board of Public Utilities.

A. C. Kingman, of the advertising department, Western Electric Company, New York, was a recent arrival at San Francisco. His stay in the Exposition City is expected to be somewhat extended, as Mr. Kingman will superintend the installation of his company's exhibit at the Panama-Pacific Exposition while on the Coast.

J. W. Goodwin has resigned as president of the Oro Electric Corporation. **Luther J. Holton** has been elected to the office of president. **R. L. Van der Naillen** was elected to the office of vice-president and general manager and acting under Holton will be responsible in all matters relating to the management and operation of the several departments of the various companies.

C. H. Christensen has been appointed manager of the Missoula (Mont.) Street Railway, the Missoula Light & Water Company and the Clark Missoula Power Company, to succeed Mr. George R. Brown, deceased. Mr. Christensen has been connected with the Missoula Light & Power Company in various capacities for twenty years. During the last four years he held the position of superintendent of the Missoula Light & Water Company's Bitter-Root Valley system.

Arthur Gunn, president of the Wenatchee Valley Gas & Electric Company, Wenatchee, Wash.; **G. H. Hoppin,** assistant to superintendent of distribution, Washington Water Power Company, Spokane; **Charles North,** superintendent Revelstroke electrical department, Revelstroke, B. C., and **Leonard Tarrow,** erector with C. C. Moore & Company, San Francisco, have been elected associate members of the American Institute of Electrical Engineers.

C. R. Weymouth, chief engineer Chas. C. Moore & Company; **Frank H. Varney,** steam-electric engineer of operation for the Pacific Gas & Electric Company; **C. T. Hutchinson,** editor of Western Engineering; **J. T. Whittlesey,** engineer Claus Spreckels Building, and **H. L. Terwilliger,** first vice-president Harron, Rickard & McCone, have been elected members of the executive committee of the San Francisco Section of the American Society of Mechanical Engineers.

John Montgomery, contract agent of the Western Canada Power Company at Vancouver, B. C., is visiting in Salt Lake City. Mr. Montgomery for several years prior to 1908 was commercial agent of the Utah Light & Railway Company. He resigned to accompany Mr. R. F. Hayward to the City of Mexico where Mr. Hayward was in charge of the construction of large hydraulic electric plants to supply additional electric power to the national capital. Mr. Montgomery later accompanied Mr. Hayward to Vancouver where he was engaged in the erection of extensive hydraulic plants and transmission lines for the Western Canada Power Company. The depression in business occasioned by the war in Europe and its effect on the British colonies has made it necessary for the power company to curtail its expenses and the services of many of its employes including those of Mr. Montgomery has been temporarily discontinued.

MEETING NOTICES.

Oregon Society of Engineers.

The regular Monday luncheon was held at the Hotel Benson on December 14th. The speaker of the day was Judge John H. Stevenson of the municipal court, who spoke upon "Municipal Problems as Seen from a Municipal Court." Walter F. Graves presided as chairman. Mr. Stevenson said in part: That there was a vast amount of machinery in the United States to get a criminal into prison, but nothing to help him to a better life after he served his sentence. He felt a great sympathy for the people who committed crime through environment and who would never have become criminals except for environment. Also some were driven to crime by poverty and want. The insane, the criminal who inherits these instincts, those of arrested development mentally should all be put away for life, but those who on the spur of the moment commit crime and boys, should have scientific treatment, which is not done nowadays. Prisons should be the last resort. He cautioned fathers to properly rear their children and said he expected crime to decrease in Portland 50 per cent when the saloons were closed. Boys' crimes, according to his observation, developed in most cases in "pool rooms." He says that he does not think boys should be allowed in them under 21 years of age. This will be the last luncheon until after the holidays.

The Jovian Electrical League of Southern California.

A well-attended luncheon of the league, held at Christopher's, Los Angeles, on Wednesday, December 16, was presided over by C. T. Carr, as chairman of the day. Following the introduction of a number of guests, Tribune Pieper read a letter from H. H. Howell, representing the San Diego Jovians, containing an invitation to the Los Angeles Jovians

to come "down south" to attend the opening of the exposition and enjoy true Southern Jovian hospitality. The three-minute talks, which were highly amusing and interesting, were given by A. B. Day, on R. W. Murphy; H. N. Sessions on C. A. Renard, and J. M. Morris, on A. B. Day. A friend of the chairman, R. R. High, then entertained the audience with a very comical, original monologue, and he was followed by a talk on "State Insurance," by W. L. McConnell, local manager of the State Compensation Insurance Fund. The speaker gave a brief resume of the common law covering accidents, insurance practices, the rights of employer and employee, and the meaning of "assumed risk" and "contributary negligence." He pointed out the shortcomings of the common law as applied to the settlement of accident cases, and referred in glowing terms to the rather recently established, but highly successful, state compensation insurance fund, which was started with a $100,000 state appropriation. About $600,000 in premiums has already been collected, and the expense of operating the fund is about 9.31 per cent of the premiums. It is proposed to return 15 per cent of all premiums earned on January 1st, and with a 25 per cent reduction in the premium rate, there is a difference in favor of the policy holders of about 40 per cent. This 15 per cent refund simply represents a saving through the state's lower expense cost, and is being made without affecting the appropriation of the legislature. In other words, the state has conducted its business at an expense of about one-fourth that of stock companies, and the saving rightfully belongs to the policy holders. In addition to the low operating cost, the state fund has, during the first nine months, handled about 3000 accident cases, only 11 of which were referred to the Industrial Commission for hearing—a record of very nearly 100 per cent satisfaction to employers and workers.

California-Oregon Electric Club.

The Electric Club of the California-Oregon Power Company, held its monthly meeting in the club rooms, Electric building, Medford, Oregon, December 18th, 1914:

The subject for discussion was Contracts, and the Menus were in the following form:

Menu.

THIS AGREEMENT, made and entered into this 18th day of December, 1914, at the Club Rooms in the City of Medford by the and between the Electric Club, hereinafter designated as the Host, and the Officers and Employes of the California-Oregon Power Company, hereinafter designated as the Guest,

WITNESSETH: That the Host being the party of the first part, for and in consideration of the covenants and agreements herein contained on the part of the Guest, being the party of the second part, does covenant, promise and agree with the said Guest in the manner following, That is to say:

First: That the Host shall and will perform, furnish and deliver under the direction of the Chairman (Pro Tem) of the Electric Club, the following articles:

Menu.

Apple Cider.
Fruit Salad Chow-Chow Celery
Baked Chicken Pie—Gravy
Mashed Potatoes Corn
Whipped Cream Pudding Cake
Coffee.

Second: That the Guest shall test and prove the above articles through his natural organs of mastication.

Third: That should the Guest find the said articles to be of proper resistance, frequency and power factor and fused properly for any overload of amps—the Guest not to indulge too freely of same, so as to cause low speed, bearing troubles or lose his way Ohm-ward.

Fourth: The party of the second part agrees to pay to the party of the first part, the sum of Fifty Cents (50c) for services rendered.

Fifth: In any event, it is mutually agreed between the parties hereto that the spirit of this contract is to have a good and enjoyable time, and in default thereof, the sum of 23 dollars shall be paid for each offense as and for current damages as provided by Ohm's Law.

In Witness Whereof, the parties hereto have set their hands and seals, the day and year first above written.

CALIFORNIA-OREGON POWER CO. ELECTRIC CLUB.
EMPLOYES OF CALIFORNIA-OREGON POWER CO.,
O. O. Alenderfer, Chairman Pro Tem.

Program—Subject, Contracts.

1. Nature and Essentials of a Valid Contract....A. C. Hough
2. Remedies for a Breach of Contract.....H. C. Stoddard
3. Forms of Contract.....F. F. Loder
4. How to Get a Contract Signed.....C. A. Malone
5. Why the Company Should Have a Contract With the City of Gold Hill for Street Lights.....C. W. Martin
6. How a Contract Properly Filled Out Aids the Commercial Department in Keeping Its Records and Aid Collections .....R. R. Ebel
7. What Can the Employes Do to Increase the Efficiency of the Present Contract Now in Use by the Company .....All Employes
8. Musical Imitations and "Near Songs".....J. L. Weiss

Those present were:

Jas. H. Moore, Glendale, Oregon; A. C. Hough, Grants Pass, Oregon; C. L. Clevenger, Grants Pass, Oregon; C. A. Malone, Ashland, Oregon; C. R. Dean, Ashland, Oregon; W. R. Johnson, Jacksonville, Oregon; and the following from Medford, Oregon: O. O. Alenderfer, J. J. Buchter, A. B. Cunningham, D. L. Colvig, G. B. Conwell, E. Curry, G. Darneille, R. R. Ebel, E. G. Henselman, F. F. Loder, Jas. Leslie, C. W. Martin, R. G. Medley, Dr. Porter, E .E. Scott, Gus Stinson, F. O. Stinson, W. H. Searle, H. C. Stoddard, J. J. Skinner, J. L. Weiss.

PACIFIC COAST ELECTRICAL JOBBERS' CONVENTION.

The regular quarterly meeting of the Pacific Coast Electrical Supply Jobbers' Association was held at Del Monte, Cal., December 16, 17, 18. While the inclement weather and the holiday season lessened the attendance, particularly of the ladies, the meeting was most profitable and enjoyable to all who attended.

Golf, as usual, was the chief attraction. It takes more than a Scotch mist to dampen the enthusiasm of the ardent golfer. The scores, however, were not up to the standard. So out of deference to the feelings of the contestants the records are omitted. In the manufacturers' contest B. A. Hansen won the jobbers' cup and the Del Monte trophy with a gross score of 96, though Sanderson's authenticated score of 73 caused much comment. Among the jobbers, C. C. Hillis, with a gross score of 89, won the copper cup and the Del Monte trophy. F. H. Leggatt won the Pass & Seymour cup and W. L. Goodwin the contractors' cup. The pool tournament was won by H. E. Sanderson, while in the absence of the ladies, S. H. Taylor was consoled with the putting prize.

At the open meeting on Friday afternoon Secretary Albert H. Elliott presented an able analysis of the new Industrial Trade Commission Act and the Clayton Bill.

The regular golf dinner on Friday evening was the occasion of much good natural raillery and flow of wit. A. H. Elliott, as toastmaster called on the various cup winners, each of whom gave brief response. The meeting then adjourned in order that the jobbers and their guests might attend the Wass Hael celebration at San Francisco.

Following is a list of those in attendance:

R. F. Behan, Westinghouse Elec. & Mfg. Co., San Francisco.
W. S. Berry, Western Electric Co., San Francisco.
T. E. Bibbins, General Electric Co., San Francisco.
T. E. Burger, Western Electric Co., Los Angeles.
C. H. Carter, Pacific States Electric Co., Los Angeles.
H. V. Carter, Pacific States Electric Co., San Francisco.
J. I. Colwell, Western Electric Co., Seattle.
A. H. Elliott, Secretary of Association, San Francisco.
W. L. Goodwin, Pacific States Electric Co., San Francisco.
N. W. Graham, Holabird-Reynolds Co., Los Angeles.
S. B. Gregory, Arrow Electric Co., San Francisco.
C. B. Hall, Illinois Electric Co., Los Angeles.

Brewster Hall, Pass & Seymour, San Francisco.
A. H. Halloran, Journal of Electricity, Power and Gas.
B. A. Hansen, A. G. Electric Co., San Francisco.
Ross Hartley, Pacific States Electric Co., Portland.
C. C. Hillis, Electric Appliance Co., San Francisco.
P. B. Hyde, Thos. A. Edison, Inc., San Francisco.
O. W. Lillard, Gould Storage Battery Co., San Francisco.
F. W. Murray, National Carbon Co., Los Angeles.
F. H. Leggatt, Western Electric Co., San Francisco.
A. H. Nylen, Gilson Electric Co., Oakland.
R. F. Oakes, American Everready Co., San Francisco.
F. H. Poss, Benjamin Electric Co., San Francisco.
H. E. Sanderson, Bryant Electric Co., San Francisco.
H. B. Squires, H. B. Squires Co., San Francisco.
C. E. Wiggin, Dunham, Carrigan & Hayden Co., San Francisco.
A. G. Young, Telephone & Elec. Equipment Co., San Francisco.

1914 WASS-HAEL.

The annual "Wass-Hael" festival of the San Francisco electrical men was held on Saturday afternoon, December 19th, at a local cafe. Four hours of feasting, fun and frolic were enjoyed by the 237 men who were fortunate in attending this celebration, which has now become an annual institution dear to the hearts of all.

Mr. Thomas E. Collins presided at the merry-making and introduced the several purveyors of amusement, as shown in the following:

James Lemon ..... Piper
Oscar Derico ..... Leader of Musicians

CAMILLE MAILHEBEAU
Chief of Cuisine

TOASTMASTER'S ADDRESS OF WELCOME
A. V. Thompson ..... Messenger Boy No. 23
Dr. Leo. J McMahon..... The Original Bacigalupi
Joe Thompson..... Making Harry Lauder Jealous

JACK HOLLAND
Injineer of the Fish Boat Rosemarie

FRANK FOWDEN
Some Voice

DICK HUNT
John's Little Brother, in a Solo

THE QUARTETTE
H. H. Daley, Carroll Morris, Fred Poss, Dick Hunt
Some Harmony

IMPROMPTU

Among those who were present were:

R. M. Alvord
Howard Aylsworth
R. A. Balzari
Dr. F. A. Balkin
J. M. Barry
Geo. H. Battee
E. W. Beardsley
C. C. Beatie
R. F. Behan
Wm. Bendel
W. S. Berry
Henry Bostwick
Chris. Bradley
H. H. Brand
A. H. Braunagel
J. E. Bridges
W. W. Briggs
A. T. Brown
E. C. Brown
J. Q. Brown
John R. Brownell
E. E. Burgess
Munson Burton
Felix Butte
Paul Butte
T. E. Collins
N. K. Cooper
H. W. Cope
H. Cordell
W. H. Cortelyan
Harry Corvin
F. J. Cram
J. E. Crilly
J. A. Crombach
B. C. Crowley
H. W. Crozier
Geo. Curtis
E. M. Cutting
H. H. Daley
K. I. Dazey
Thos. Degen
Eddy Dewald
S. B. Gregory
E. E. Gribble
C. B. Hall
W. B. Hall
W. F. Hall
Max Hallauer
A. H. Halloran
Milton Hamilton
Ed. Hammer
Harry Hand
W. S. Handbridge
W. W. Hanscom
A. B. Hansen
Percy Hardenberg
C. E. Hardy
A. M. Harvey
H. L. Harkness
Maury Harriman
Dave Harris
F. W. Harrison
P. N. Harrison
T. A. Hays
C. E. Heise
Al. Herbert
C. D. Herbert
J. P. Hermans
Ben Herr
Frank Herrguth
Mel Herzog
C. C. Hillis
R. D. Holabird
Jack Holland
Nelson M. Hope
John Hunt
R. H. Hunt
Fred E. Hummel
P. B. Hyde
H. F. Jackson
Sam Johnson
Fred H. Jones
G. Douglas Jones
Max Jones
H. R. McAlmon
O. P. McCord
R. P. McGrath
M. C. McKay
W. L. McKinley
J. McLaine
Dr. Leo. McMahon
R. E. McMurry
C. E. Mynard
J. A. Nadon
Lee H. Newbert
Harry Noack
R. F. Oakes
A. V. Olsen
P. C. Paddock
A. J. Pahl
F. W. Patterson
Chester Pennoyer
Fred Poss
V. H. Poss
J. J. Pottinger
W. R. Pounder
R. D. Plageman
Dick Quarg
F. J. Quinn
M. Rhine
R. T. Robb
Hans Robscheidt
E. T. Rosenlund
Arthur Rowe
S. R. Russell
H. E. Sanderson
M. L. Scobey
B. C. Scott
J. G. Scrugham
H. J. Seiler
Herbert Smith
F. P. Sommers
L. A. Sperry
E. Sproul
M. F. Steel
Geo. Stilger
Harry Dodge
A. Drendell
W. R. Dunbar
Bill Dunphy
A. B. Edes
C. W. Edgecomb
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The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

By the Secretary.

The prime purpose of the Code Committee, National Fire Protection Association, is to draft specifications for safe electrical construction and the practical accomplishment of this task is aided by experts representing interests affected by results attained. The regular bi-annual meeting of this committee will be held in March, 1915. Current news items in electrical magazines and pamphlets issued from private sources indicate that representation will be made at this time proposing a cheaper method of wiring buildings. These representations will probably be accompanied with specifications worked out by proficient specialty engineers.

All persons will concede that if the cost of installation is reduced, the demand for use of electricity will increase and that, if the proper degree of safety is maintained, the community will be benefited; but just how this wonder working is to be effected will be interesting to learn.

In the last ten years development in manufacture of electrical trade material in the United States has been rapid and the efficiency of the workman has increased with this development so that for high class installations of concealed wiring the cost is less than maintains throughout Europe for installations of exposed work, standards, cost of living, etc., considered.

In view of the present day tendency to speak lightly of the hazards due to poor electrical installations, the following may be of interest. If we assume that in the construction and equipment of a building there are ten sources which may cause fire, including hazards due to faulty wiring; that there are 100 buildings in four adjacent city blocks, and that there is a $\frac{1}{1000}$ chance of fire from each of the ten sources in each building, then the degree of probability of fire for the 100 buildings is represented by unity, or certainty. The possibility of fire in any of the buildings is not affected by the degree of probability, and the actual event in one building does not affect the possible event in any other.

NEWS NOTES

FINANCIAL.

SAN FRANCISCO, CAL.—E. H. Rollins & Sons will purchase and extend $400,000 Ferries and Cliff House 6 per cent bonds, an underlying security of the United Railroads. The remaining $200,000 will be paid at maturity. The present arrangement provides for extending $400,000 to December 31, 1916, or two years from the expiration of the first extension. It is understood that the company has provided for the cancellation of $200,000 of the bonds out of current earnings.

INCORPORATIONS.

SACRAMENTO, CAL.—Aerial Electrical Company, $100,000, by J. L. Harvey, J. L. Flanagan, Jim and Abbie Thompson.

LOS ANGELES, CAL.—The Telegraph Transmitter Company, $125,000, subscribed in full, by F. D. Fowler, C. G. and Ada E. Taylor.

SAN FRANCISCO, CAL.—Surface Electric Railway Supply Company, $25,000, shares $1 each, subscribed $3, by J. A. Wheeler, S. G. Mitchell and S. Theisen.

ILLUMINATION.

SAN BERNARDINO, CAL.—The Yuma Gas Company has decided to change its principal place of business from this city to Los Angeles, on December 28th.

CLATSOP, ORE.—The board of directors has granted to the Pacific Power & Light Company a 50 year franchise to operate and maintain a power service here.

HERMOSA BEACH, CAL.—The Enterprise Electric Company has been awarded a contract to install an electric line to light the concessions at the outer end of the pier.

GOLDHILL, ORE.—Bids will be received until January 11 for the installation of a street lighting system, and furnishing electric current therefor for a period of ten years.

SODA SPRINGS, IDAHO.—A special election has been called for December 28th to vote upon the issuance of $15,000 worth of bonds for the installation of a municipal lighting plant.

CULDESAC, IDAHO.—W. L. Marrs, recently granted a light franchise here, is repairing the old E. P. Atchison plant for use until extensive improvements can be made and a new light system be installed.

GOLD HILL, ORE.—Bids will be received until January 4th by B. G. Harding, recorder, for the contract for street lighting system for the city. Plans and specifications to accompany bids. Certified check for $600 to accompany bid.

MONTESANO, WASH.—Plans for a new electric power plant here to be ready for operation by spring have been prepared for the Northwest Electric & Water Works Company. Plans include steam power plant located on water front.

PITTSBURG, CAL.—The Contra Costa Gas Company promises that gas will be ready for delivery by March next. Following the introduction of gas service to Pittsburg the company will extend its system to Antioch, then to Concord and Martinez.

FORT BIDWELL, CAL.—It is said that a gas lighting plant is soon to be installed at Eagleville by H. H. Dunbar, R. R. Rice and J. McCosh Smith, and it is understood these same gentlemen intend to install a similar gas plant at Fort Bidwell in the near future.

VICTORVILLE, CAL.—The Southern Sierras Power Company has purchased the interest of G. H. Christ in the Victorville Electric Light & Power Company and will at once put in street lights, contract for which was approved by the county supervisors some time ago.

STOCKTON, CAL.—The city of Stockton, Cal., has accepted the bid of the Western States Gas and Electric Company for street and boulevard lighting for a term of five years from December 15th. The contract will cover the present system and certain additional lighting.

PHOENIX, ARIZ.—At a recent meeting of the city commission, a contract with the Pacific Gas & Electric Company whereby the city secures current for all lighting and power purposes at 2½ cents per kilowatt hour, was accepted by the commission over the protest and negative vote of the mayor.

BAKER, ORE.—An election will be held at an early date for the purpose of voting on bonds in the sum of $180,000, the proceeds of which are to be used in the construction of a municipal lighting plant. L. R. Stockman has been employed to prepare plans for the plant and J. L. Stannard is consulting engineer.

PORTLAND, ORE.—Electrical workers and small electrical contractors of this city won the recent fight against incorporating in a proposed new electrical code, a provision requiring that a cash bond in the sum of $100, in addition to a surety bond of $500, be deposited with the city to guarantee the proper installation of electrical fixtures.

ABERDEEN, WASH.—With the passage of the ordinance in the election at Hoquiam granting a franchise to L. H. Burnett and associates, Mr. Burnett's company has secured the entire field in the Grays Harbor country to carry on their proposed line of gas enterprises in Chehalis county. After the first of the year the company will start building in Montesano and Elma.

BOISE, IDAHO.—The assessment roll covering the special street lighting recently put in operation in this city will be ready for the approval of the city council at its next meeting. All points of adjustment have been worked to a satisfactory conclusion and the city engineer's office is at work figuring the individual apportionment of all of the property owners in the district. After the assessment roll has been approved the council will set a day of protest at which time all property owners who for any reason are not satisfied with their apportionment of the expenses may enter a protest for a readjustment of their assessment.

TRANSMISSION.

WALLACE, IDAHO.—The Montana Power Company is making rapid progress in extending its transmission lines into the Coeur d'Alene district.

SACRAMENTO, CAL.—The Great Western Power Company has secured the contract for furnishing power to the new city pump. The contract, which will run for five years, amounts to about $20,000 per year.

GREEN RIVER, UTAH.—The Green River Irrigation District, of which S. J. Meer is city clerk, will receive bids up to January 4, 1915, on bare and insulated copper, insulators, pins, cross arms, and other line material for seven miles of transmission of distribution lines for the electric light system to be installed here. Also for the manufacture, delivery, and erection of hydraulic and electrical apparatus

to be installed in the power house of the Green River Irrigation District and on 275-30 to 35 foot cedar poles. Plans and specifications for this material may be obtained from the city clerk.

TOOELE, UTAH.—The Clark Electric Power Company of this city has entered into a contract with the Utah Power & Light Company to purchase their requirements of electric power on a wholesale contract from the latter company. The local electric company has been taking about 200 horsepower under this contract since December 1st, and are now in a position to give first class service to their customers. Superintendent Anderson of the Clark Electric Company has instituted a number of innovations to encourage the installation of meters and the use of continuous current, which will not only result in benefit to the company's patrons but also in an economy of power for the company.

TRANSPORTATION.

CALDWELL, IDAHO.—Citizens have agreed to take bonds of the Caldwell Traction Company to finance the construction of the Wilder branch of the Oregon Short Line. The estimated cost of electrifying is $50,000.

SEATTLE, WASH.—Scott Calhoun, one of the receivers of the Seattle, Renton and Southern Railway Company, alleges in a suit brought to set aside a contract for current, that the Puget Sound Traction, Light and Power Company was organized in violation of the anti-trust laws of the State of Washington and the United States.

SAN FRANCISCO, CAL.—The supervisors rejected the proposition to build a cable line on Church street by a vote of 9 to 8. They instructed the board of public works to prepare plans for the construction of an extension to the Municipal Railway in Church street using appropriations already voted by the board. The vote on this was 14 to 3.

SAN FRANCISCO CAL.—The contract for constructing the California street Municipal Railway line has been awarded to F. Rolandi, the lowest bidder, for $101,308. In addition, a maximum bonus of $7500 for quick completion is provided for, and about $4000 will be required in connection with paving. Rolandi will begin at once at Second avenue and Geary street. He is to have the track constructed to California street and Sixth avenue by January 3d, which will be the last day on whch the United Railroads' cars will run on California street between Sixth and Thirty-third avenues.

SEATTLE, WASH.—A report as to the estimated cost of operation, cost of maintenance, improvements needed, and expected earnings of the Seattle, Renton and Southern Railway has been prepared and submitted to Mayor Gill of this city for the enlightenment of the city council. The report was compiled by A. L. Valentine, superintendent of public utilities; A. H. Dimock, city engineer, and J. D. Ross, superintendent of the lighting department. The report places the receipts of $320,000 under municipal control with minimum wage and eight-hour day and the outlay at $236,010, including interest and improvements.

SALT LAKE CITY, UTAH.—Installation of an added unit to the company's storage battery system has been completed by the Utah Light & Traction Company, increasing the capacity of the system between 25 and 30 per cent. The original storage battery system was installed six years ago in the company's power station and transmission plant in the square bounded by First South and Second South streets and Main and West Temple streets. The plant was installed as an emergency equipment, to carry the normal elevator load and other direct current load handled by the company for thirty minutes, in the event of trouble with the generating and transmission plants supplying service in the business district.

TELEPHONE AND TELEGRAPH.

FALLON, NEV.—The Bell Telephone Company has been granted a franchise along the old Southern Pacific roadbed in the northern part of the county, where a line was recently constructed.

VALLEJO, CAL.—In view of the fact that inshore wireless stations are now being advocated by radio experts, Sawyer Island, just north of Mare Island, has been selected as the location for a high power plant for the government.

SILVER CITY, N. M.—As the result of investigations and recommendations of Geo. Kimball, special agent for the Mountain States Telephone & Telegraph Company, Mogollon is to have its own telephone exchange, connecting with Cooney, Alma and outlying districts of Socorro county by a toll and subscription line and linked to the city by toll line. A new 100 line switchboard will be installed.

CALIPATRIA, CAL.—The first telephone exchange in the north end of Imperial Valley is being installed by the Bell Telephone Company in Calipatria. Service previously given here through a pay station was inadequate to the business of this city and its immense surrounding farming district, and officers of the telephone company from Los Angeles and other points have been here for several days arranging the establishment of a central station and the putting up of lines all through the business, residential and agricultural sections. The work will be pushed as quickly as possible and complete local and long distance service will be available within a brief time.

LOS ANGELES, CAL.—The Safety Commission, acting as an advisory board to the bureau of Fire alarm and police telegraph, has filed an exhaustive report with the city council, recommending the installation of a complete new fire alarm and public telegraph system, covering the entire city. The commission consists of Councilman Snowden, Fire Chief Eley, Chief of Police Sebastian, and City Electrician Manahan. It is recommended that the central station be located in the fire-proof engine house near the corner of Seventh and Figueroa streets, but that at the earliest possible time a special building be erected for it in one of the city parks, so as to be immune from destruction in a general conflagration.

WATERWORKS.

LOS ANGELES, CAL.—At a meeting of the Board of Supervisors a franchise for water pipe lines in Tract No. 2704 was awarded to John Carner.

SEATTLE, WASH.—Water pipe franchises have been granted to Patrick Downey and A. B. Strong of Bellevue, Wash., for a term of 10 years.

VALLEJO, CAL.—Officer G. A. McKay, has received authority from the Navy Department for the installation of an extension to the salt water fire system at Mare Island, at a cost of about $10,000.

REEDLEY, CAL.—All bids recently submitted to the city for the construction of a building and the installation of an anxiliary pumping plant for the city water works were formally rejected. Trustees will take further action in the matter at an early date.

GOLDFIELD, NEV.—Bessie Miller, of Dyer, Nev., has applied to the State Engineer for permission to appropriate waters from Fisk Lake and its tirbutaries by means of pumping plants, canals, aqueducts, ditches and pipe lines for irrigation and domestic purposes.

NORTH YAKIMA, WASH.—Notice has been received of the award of construction constracts on the Bonton Exension. Excavation to Rowan & Anderson; steel flume, Oregon Bridge Company, and woodstave pipe to the Washington Pipe Company. Concrete work is estimated at $13,000, which will bring the cost to about $69,000.

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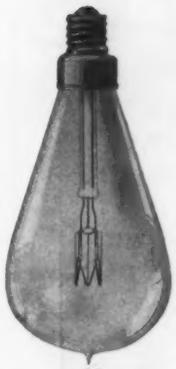

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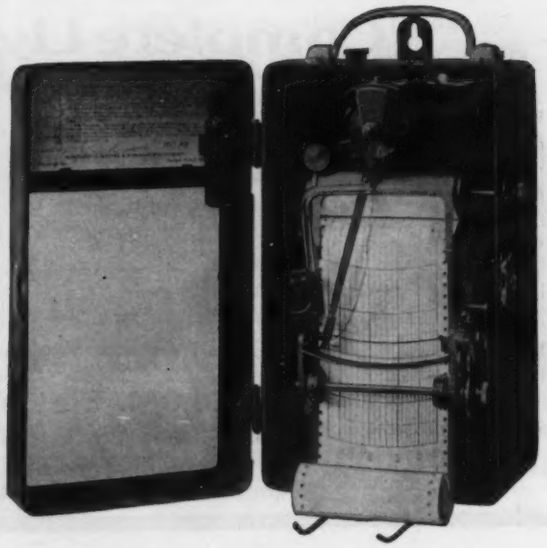

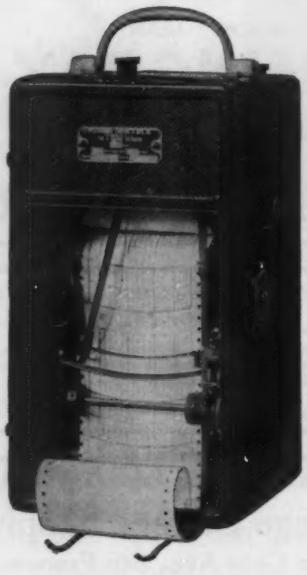

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47	Cable	7.5
101	Pin	25.
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296	Pin	10.
298	Pin	15.
311	Pin	33.
315	Pin	40.
351	Pin	60.
408-A	Pin	27.
601	Anchor	10.
2057	Pin	27.
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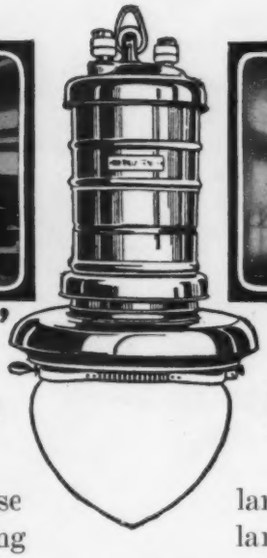
Type "W" Flame Arc Lamps



Specify these lamps always for lighting large spaces.

They are constructed to give a wide distribution of brilliant light over wide areas.

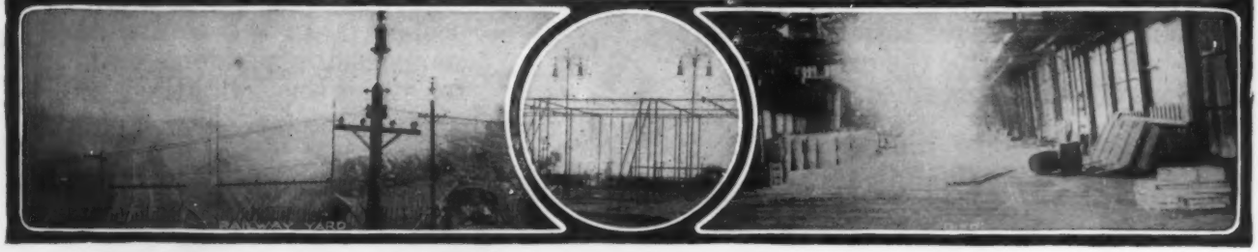
The type "W" Flame Arc Lamp is one of the most powerful lighting units known. Because of its penetrating light, continuity of service, economy of installation and maintenance, this efficient lamp is especially adapted to the illumination of Foundries. Machine Shops, Construction Works, Enginering projects, railway waiting rooms and yards, theatre fronts, docks, piers, etc., etc.

Thousands of Type W Flame Arc Lamps are in satisfactory service all over the country.

Write for further information

Installations.
Penn. R. R. Co.
Pullman Car Works.
Gt. West. Smelting & Ref. Co.
Union Malleable Iron Wks.
Coon Rapids Dev. Co.
Corn Producers Ref. Co.
etc., etc.

Installations.
Standard Oil Co.
Commonwealth Ed. Co.
Chicago Sanitary Dist.
St. Paul Gas Lt. & Pr. Co.
Omaha Elec. Lt. & Pr. Co.
Alton Gas & El. Co.
etc., etc.



General Electric Company

Pacific Coast Sales Offices in San Francisco, Los Angeles, Portland, Seattle and Spokane
Rocky Mountain Sales Offices in Denver, Colorado; Salt Lake City, Utah; and Boise, Idaho

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The Trade Mark of the Largest Electrical Manufacturer in The World.

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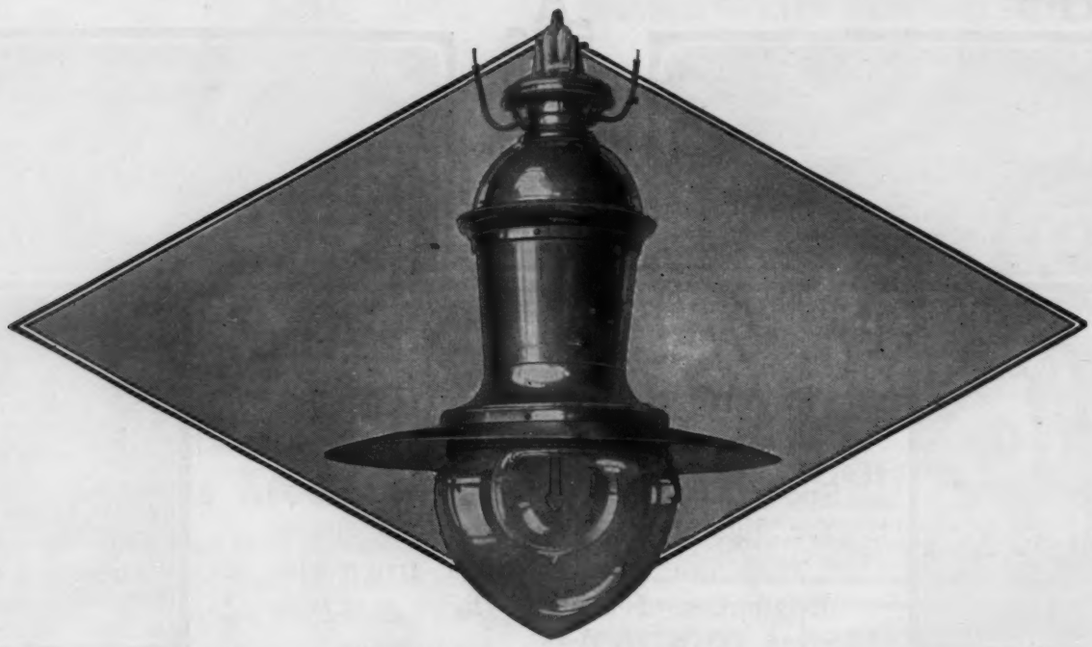

Novalux

"Novalux" is the new name given to all G-E pendent and ornamental units wherein the new sizes of series MAZDA Lamps are used.

Maximum efficiency of these new high candle-power lamps is obtained at high current values. To get this high current for efficient street lighting the Novalux compensator unit has been especially designed.

It contains an individual compensator for correct operation of the 20 ampere lamps on 6.6 and 7.5 circuits, saving about 25% of the energy required for straight series.

In addition to the excellent efficiency obtained, the design of the compensator is such that regulation is very appreciably improved.

There are two sizes of compensators used with the 600 and 1,000 c. p. 20 ampere Series MAZDA Lamps respectively; they are equipped with taps for either 6.6 or 7.5 ampere series alternating current circuits. The efficiency of these compensators is about 95% with a power factor of 98.

NOVALUX

To obtain the most satisfactory operation and the greatest value from these new high candle power lamps use Novalux self-contained compensator pendent units for street series lighting.

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Two Useful Books for Electric Vehicle Users

The "Exide"

Charging System for Garages

An efficient and economical charging system for electric vehicle owners or garages where a number of batteries are regularly charged. It lengthens the life of batteries,—saves time, labor and power.

"Boosting"

The usefulness of electric vehicles can frequently be materially increased by "boosting" batteries. Some operators of "Electrics" do not appreciate the added service which is made possible by this method of charging batteries. This book is full of useful and valuable information for electric vehicle users.

THESE BOOKS ARE FREE. WRITE THE NEAREST OFFICE FOR COPIES.

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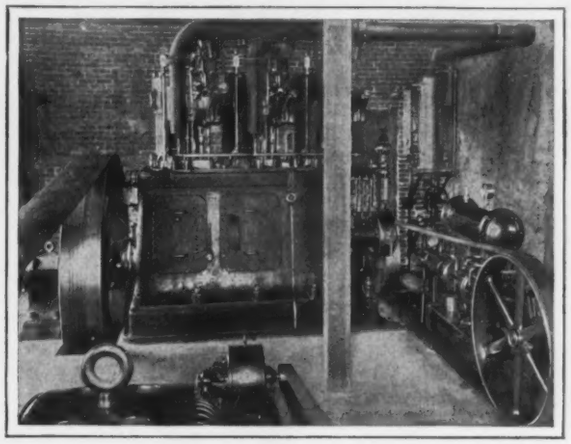


A 120-BRAKE HORSE-POWER

DIESEL ENGINE

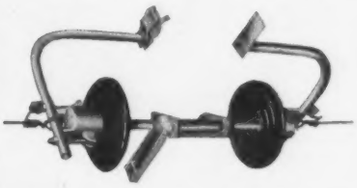
IN

KANSAS, built and installed by our company, does more work on 45 gallons of FUEL oil than the old superseded steam plant ever did on 280 gallons—on the same schedule and same load conditions. ¶ The DIESEL will do as well for ***you—Better service at less cost.***

BUSCH-SULZER BROS.-DIESEL ENGINE CO.
ST. LOUIS U. S. A.

SECTIONALIZES THE LINE

and requires no extra insulators. The



K-P-F SWITCH

is mounted on standard crossarm and has other advantages.

Bulletin 102

K-P-F ELECTRIC CO.

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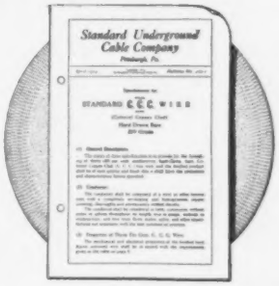

This New Bulletin

will be sent you on request. It contains information regarding 30 per cent

Colonial Copper Clad Wire

TRADE C.C.C. MARK

If you are interested in copper clad bond wires, weatherproof or rubber insulated wires, write for your copy.

Standard Underground Cable Co.

Pacific Coast Dept.,

1st National Bank Bldg., San Francisco, Calif.

Los Angeles Portland Seattle

Still Leading The Way

The Sprague Electric Works were pioneers in the ventilating field. From the start they have led the way. Today they still lead the field. Their product shows it.

Rugged construction, noiseless, economical operation, needing no attention other than an occasional oiling, are the characteristics of Sprague Electric Outfits.

Write for Descriptive Bulletin No. 24654.

Sprague Electric Works

OF GENERAL ELECTRIC COMPANY

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The STANDARD for RUBBER INSULATION

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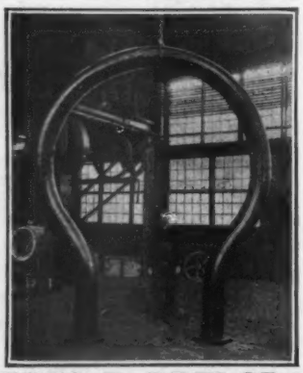

A 10 in. expansion bend made from one continuous piece of full weight pipe 30 feet long for the San Joaquin Light and Power Company, California.

Let us show what we can do for **you**.

Pittsburgh Piping and Equipment Co.

THEO F. DREDGE Pacific Coast Representative
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Simplex Electric Ranges

are consistent users of day current and makers of new buyers of SIMPLEX appliances, because they give universal satisfaction.

This "Silent Salesman" should be working for you in every home where there is electricity.

The season is now on.

Order today and reap the benefits tomorrow.

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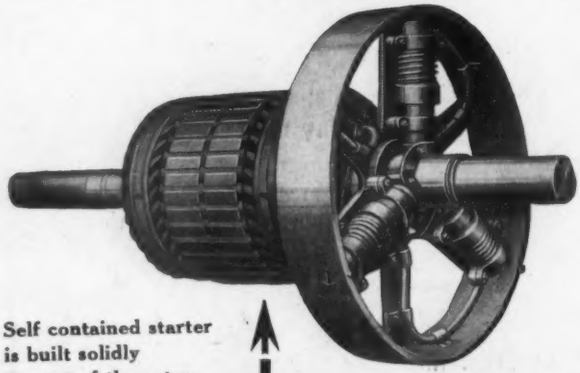

Self contained starter is built solidly as part of the rotor

Put the Starting Switch Anywhere

and whether it is near the motor or at some remote point, a line switch is the only starting device you will need. The rest is built in the motor—solidly—simply with hardly a moving part. Mistakes can't be made because there is only one thing to do; close the switch to start—open it to stop.

Fairbanks-Morse Type "KBV" Internal Starter Induction Motors

Pick up load smoothly, easily without line disturbance. Start quickly under light loads, slower under heavy ones—accommodating themselves automatically to every load condition.

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